Another new development using

B. F. Goodrich Chemical Company *raw materials*

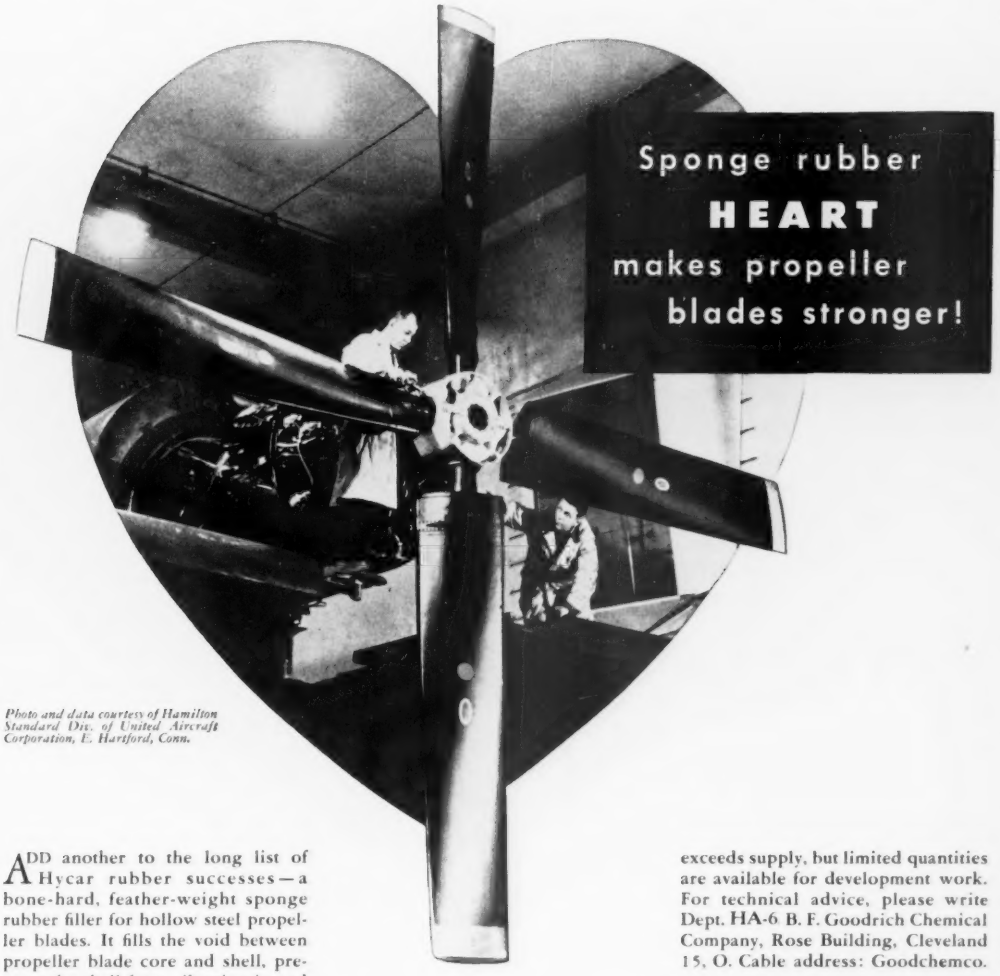

Photo and data courtesy of Hamilton Standard Div. of United Aircraft Corporation, E. Hartford, Conn.

ADD another to the long list of Hycar rubber successes—a bone-hard, feather-weight sponge rubber filler for hollow steel propeller blades. It fills the void between propeller blade core and shell, prevents the shell from vibrating in and out. It also supports the shell against the impact of rocks, ice and other material thrown up by the plane's undercarriage.

To find this filler took several years of search and tests of nearly a thousand rubber compounds. The winner contained phenolic resin, nylon, and an oil-resistant Hycar rubber compound. The presence of Hycar gives added toughness to the phenolic-nylon blend.

Hycar nitrile rubber's versatility helped make this new material possible. For Hycar has high resistance to heat, cold, cooling liquids, gas, weather and wear. It has excellent compression set characteristics, good aging properties and low moisture vapor permeability.

Hycar's advantages make it ideal for many civilian and defense products—in developing entirely new ones. Right now demand for Hycar exceeds supply, but limited quantities are available for development work. For technical advice, please write Dept. HA-6 B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, O. Cable address: Goodchemco.

B. F. Goodrich Chemical Company
A Division of The B. F. Goodrich Company

Need extreme temperature resistance? Hycar has it—plus abrasion resistance and more advantages.

Hycar
Reg. U.S. Pat. Off.
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GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers
HARMON organic colors

Conditions rugged? Roads too rough?

Use **Philblack*** **O.** *It makes tires tough!*

Abrasion resistance has not been determined for the hoofs of mountain goats but just compare Philblack O with other blacks in either synthetic or natural rubber compounds.

And there this high abrasion resistant furnace black, Philblack O, really shines. Tire treads, particularly cold rubber treads, made with Philblack O soak up punishment and ask for more.

All by itself, Philblack O rewrote the record book on long, dependable mileage at high speeds and heavy loads. For tough jobs well done, use Philblack O.

Our technical service representatives are available to assist you in compounding and processing problems. Or consult the Philblack Sales Service Laboratory in downtown Akron. Philblack O is shipped in bags or in bulk in hopper cars specially designed to facilitate unloading.

PHILLIPS CHEMICAL COMPANY

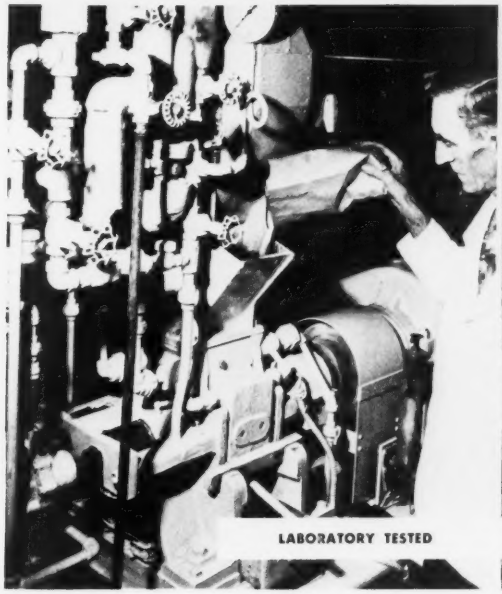
PHILBLACK SALES DIVISION

EVANS BUILDING · AKRON 8, OHIO

PHILBLACK EXPORT SALES DIVISION · 80 BROADWAY · NEW YORK 5, N. Y.

* A Trademark

Philblack A and Philblack O are manufactured at Borger, Texas. Warehouses in Akron, Boston, Chicago and Trenton.
West Coast agent: Harwick Standard Chemical Company, Los Angeles. Canadian agent: H. L. Blachford, Ltd., Montreal and Toronto.



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PROVED in the laboratory—proved in production—you get better dispersions with PLIOLITE S-6B. Where other resins give you marginal dispersions, PLIOLITE S-6B gives you excellent dispersions—and where other resins give you poor dispersions, PLIOLITE S-6B gives you marginal dispersions. You can be sure of securing the physical characteristics you want in your compounds—using natural or synthetic rubbers—when you reinforce with PLIOLITE S-6B.

PLIOLITE S-6B is used in a wide range of finished products, including shoe soles, rubber flooring, extruded wire insulation and molded rubber items of various types. And right now—while PLIOLITE S-6B is in temporary short supply—you can evaluate it in your own laboratory in preparation for your own use.

Send today for full details and sample for evaluation to:

Goodyear, Chemical Division, Akron 16, Ohio

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Pliolite—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

"Man, am I glad our liners are CLIMCO PROCESSED!"

"Since the boss sent our liners to Cleveland Liner for processing, we've had no trouble from stock adhesions—no down time—the work moves along smoothly."

As your stock leaves the calendar, roll it into a Climco Processed Liner. You will save costly production delays by getting perfect separation at the bias cutter and cutting tables. Many other advantages are to be had through the use of Climco Liners: Horizontal storage of stocks is facilitated . . . lint and ravelings are eliminated . . . freshness and tackiness are preserved . . . gauges can be more closely maintained . . . latitude in compounding is enlarged . . . brushing and cleaning of liners are avoided and liner life is increased several times.

Let us tell you about Cleveland Liner's twenty-five years service to the rubber industry. Better yet, give Climco Processed Liners a trial in your plant.

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CLIMCO
PROCESSED LINERS
Serving the Rubber Industry for 25 Years

Good Steer for your products

If you'd add new life, looks, or quality to your products, set your course for Naugatuck. *We cover the waterfront* with a full line of Latices, Lotols and Dispersites for coatings, dippings, bondings, saturatings. *For new product ideas and new product performance, write to Connecticut address below.*

Typical Naugatuck-processed products are shown above. Tires, hair stuffing, tape, decorative paper, conveyor belts, toys, masks, adhesive, clothing. There are hundreds more—every one a better product thanks to Naugatuck.

We Cover the Waterfront

Lotol Compound Latices—Ready to Use.

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Nitrex Butadiene Acrylonitrile Copolymer Latex.

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Dispersite Aqueous Dispersion of Rubber, Reclaimed Rubber or Resins.

Naugatuck Chemical Division of UNITED STATES RUBBER COMPANY

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BRANCHES: Akron • Boston • Charlotte • Chicago • Los Angeles • New York • Philadelphia

Rubber Chemicals • Aromatics • Synthetic Rubber • Plastics • Agricultural Chemicals • Reclaimed Rubber • Latices

Chemicals you live by

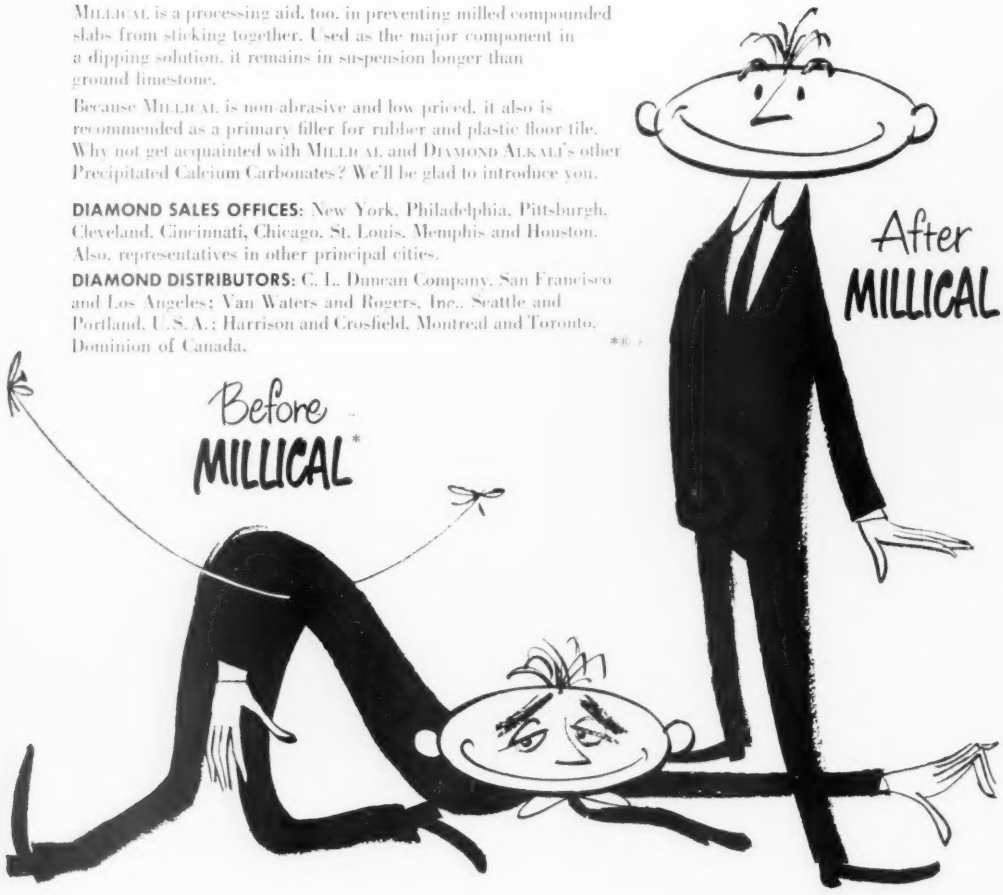
Uncured or green stocks have an unfortunate tendency to sag or collapse when cured in open steam. Many makers of extruded materials are solving this problem by compounding with MILLICAL. Due to its fine particle size this DIAMOND Precipitated Calcium Carbonate exerts a stiffening effect on the stock, reduces rejects during curing.

MILLICAL is a processing aid, too, in preventing milled compounded slabs from sticking together. Used as the major component in a dipping solution, it remains in suspension longer than ground limestone.

Because MILLICAL is non-abrasive and low priced, it also is recommended as a primary filler for rubber and plastic floor tile. Why not get acquainted with MILLICAL and DIAMOND ALKALI's other Precipitated Calcium Carbonates? We'll be glad to introduce you.

DIAMOND SALES OFFICES: New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Chicago, St. Louis, Memphis and Houston. Also, representatives in other principal cities.

DIAMOND DISTRIBUTORS: C. L. Duncan Company, San Francisco and Los Angeles; Van Waters and Rogers, Inc., Seattle and Portland, U.S.A.; Harrison and Crosfield, Montreal and Toronto, Dominion of Canada.



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DIAMOND ALKALI COMPANY...CLEVELAND 14 OHIO

DIAMOND ALKALI CHEMICALS

SURGEON'S GLOVE SHOWS RESULTS YOU GET with Wing-Stay S

LASTING QUALITY *is assured for these surgeon's gloves thanks to antioxidant protection supplied by WING-STAY S. Photo courtesy Wilson Rubber Company.*

USE PROVED *Products*

SOFTENING or oxidation-caused deterioration in a surgeon's glove could be fatal. That's why this leading maker of surgical gloves turned to WING-STAY S in his white translucent glove. For this use-proved, Goodyear antioxidant is both nonstaining and nondiscoloring—and easily withstands fifty sterilizations in boiling water due to its low water extractibility.

WING-STAY S protects synthetic as well as natural rubber stocks—it is incorporated in GRS-26 during manufacture—and is used in a wide variety of white and light-colored items such as flooring, wringer rolls, bath mats, rubber footwear—as well as in many foamed natural rubber products. Wherever an ideal combination of low cost, non-staining and antioxidation is indicated, it will pay you to investigate WING-STAY S.

Although WING-STAY S is currently in short supply, you can put it to the test in your laboratory now. Write today for samples for evaluation and full details to:

Goodyear, Chemical Division, Akron 16, Ohio

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Wing-Stay—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

Q. How can these Rubber Products be made FASTER and EASIER at LOWER COST?

A. By using U.S. *DIP-PROCESS* RECLAIMS

Yes, if you make any of the products we have emphasized in the above illustration, as well as many others, you can achieve greater speed, greater ease of processing and greater economy by including one of the famous U. S. *Dip-process* Reclaims in your formula. In addition, you will add to, instead of detract from your quality, by using *rubber itself* as a plasticizer.

Especially suited for use with "cold" rubber, U. S. *Dip-process* Reclaims have low Mooney values. This greater plasticity means larger Banbury loadings, shorter mixing time and lower power consumption. U. S. *Dip-process* Reclaims mix and tube cooler which minimizes the danger of "scorching". AND REMEMBER . . . with U. S. *Dip-process* Reclaims, you can USE 10% LESS than with *ordinary* reclaims and GET THE SAME RESULTS. This creates ANOTHER important economy for you. Why not drop us a line, tell us what you make, and we'll send you complete details as well as samples for testing purposes. U. S. Rubber Reclaiming Company, Inc., P. O. Box 365, Buffalo 5, N. Y. Trenton agent: H. M. Royal, Inc., 689 Pennington Ave., Trenton, N. J.

68 years serving the industry solely as reclaimers

U.S. RUBBER RECLAIMING COMPANY, INC.

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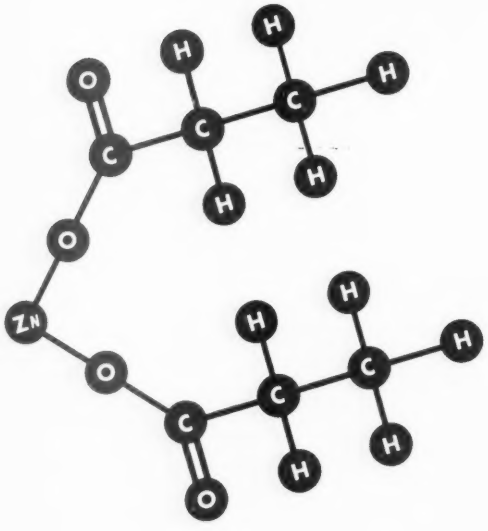
SALES REPRESENTATIVES AND WAREHOUSE STOCKS Akron Chemical Company, Akron, Ohio • Ernest Jacoby and Company, Boston, Mass. • Herron & Meyer of Chicago, Chicago, Ill. • H. M. Royal, Inc., Los Angeles, Calif. • H. M. Royal, Inc., Trenton, N. J. • In Canada St. Lawrence Chemical Company, Ltd., Montreal and Toronto

ACTIVATOR NEWS

HORSE HEAD PRODUCTS

A supplement to THE ACTIVATOR—the house organ issued by The New Jersey Zinc Company for over 15 years to aid the Rubber Industry in its use of Zinc Oxide.

FAVORED FORMULA FOR FASTER PROCESSING of ZINC OXIDE



Introduced to the Rubber Industry just a few years ago, this chemical (zinc propionate) is already the most favored processing and dispersion aid for zinc oxide.

It is available to the Rubber Industry in the form of a coating on zinc oxide, favorably modifying its physical properties without interfering with its activating characteristics.

Zinc propionate is formed as a coating on zinc oxide when the latter is treated with propionic acid at an elevated temperature. This coating forms around the individual particles, modifying their characteristics in these 3 ways:

1. **Prevents formation of aggregates—aids dispersion and reinforcement.**
2. **Provides faster wetting by rubber—cuts mixing time.**
3. **Adds plasticizing effect—speeds processing.**

These advantages, available only in Protox* zinc oxide, are proved by many manufacturers, as Protox is today the most widely used brand of zinc oxide. As one Banbury operator puts it, Protox-166 "streaks in" or "smears into the rubber" while untreated zinc oxide "spots in."

*U.S. Patents 2,303,329 and 2,303,330

THE NEW JERSEY ZINC COMPANY

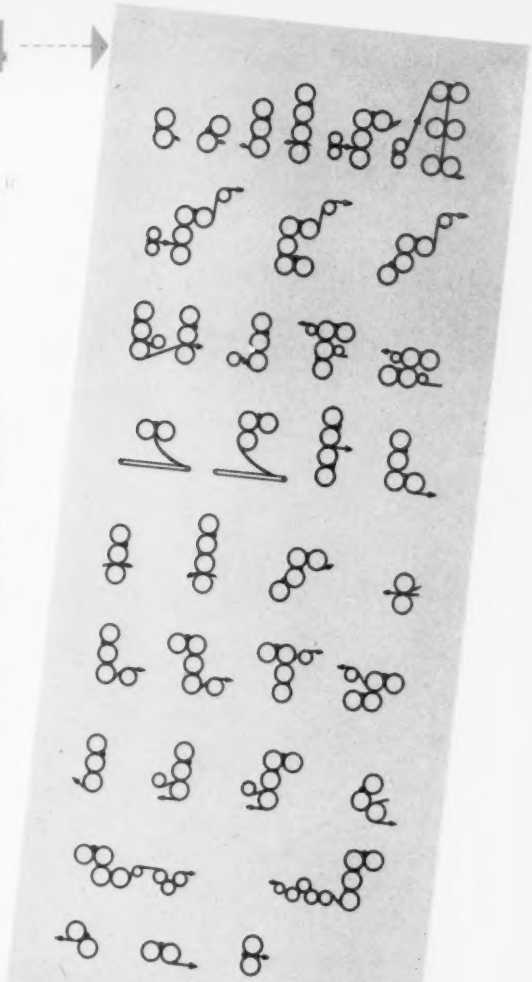
Producers of Horse Head Zinc Pigments

... most used by rubber manufacturers since 1852

160 Front Street, New York 38, N. Y.

HORSE HEAD PRODUCTS

THE ODDS ARE 34 TO 1 ? Farrel-Birmingham Has Designed Your Calender



Farrel-Birmingham has built every one of the calenders represented by these thirty-four diagrams. As a result, you can be almost certain that the basic design for the "specialized" machine you require has already been worked out by F-B engineers and proved on the job.

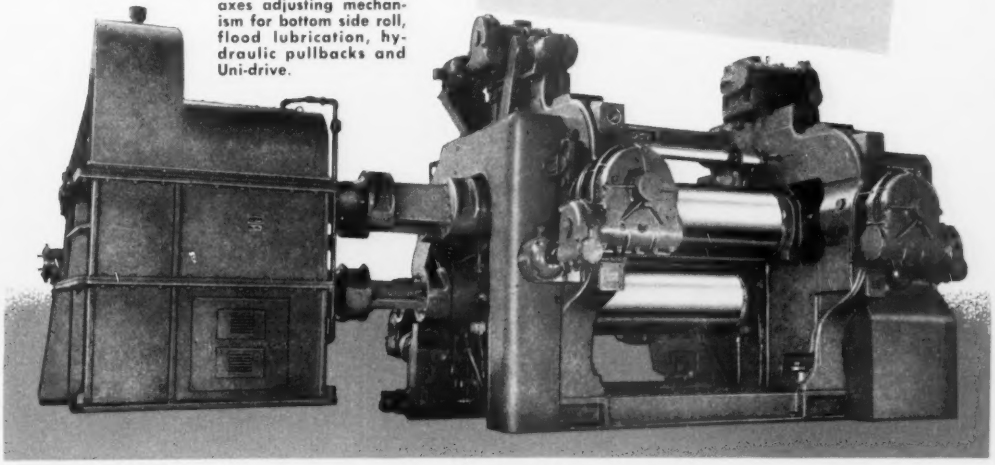
But this does not mean that the calender you buy will be an off-the-shelf machine. To the contrary, physical proportions, materials, type of construction, lubricating system, gearing, special operating features – in fact, every detail of every calender is designed for a specific job.

Why not take advantage of Farrel-Birmingham's unequalled experience. We will engineer a calender with any combination of design features and attachments necessary to fill your particular requirements. For further details, send for a copy of Bulletin 174.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT
Plants: Ansonia and Derby, Conn., Buffalo, N.Y.
Sales Offices: Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston.

Farrel-Birmingham

FB-713



32"x92" four-roll, Z-type calender with crossed axes adjusting mechanism for bottom side roll, flood lubrication, hydraulic pullbacks and Uni-drive.

The KEY to Better Plastics

HARCHEM

HARFLEX
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PLASTICIZERS

The quality of a plastic is no better than the quality of the plasticizer used therein.

You can be sure of highest quality and consistent performance with HARFLEX PLASTICIZERS.

PHTHALATES ADIPATES

HARFLEX 500®

SEBACATES

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Heel and Sole Processing is Easy

Heel and sole rubber compounding is far easier with PELLETEX on the job. The old problem of how to balance the quality desired against cost and processability finds a modern answer in a PELLETEX application.

Manufacturers prefer PELLETEX for the filler, because it has all the essentials necessary for longest-term, quality service. PELLETEX gives soles and heels just the right degree of abrasion resistance, tensile strength, aging properties, and "snap" for constant flexing. There isn't any other filler able to match the consistent, superior performance of PELLETEX SRF carbon black.

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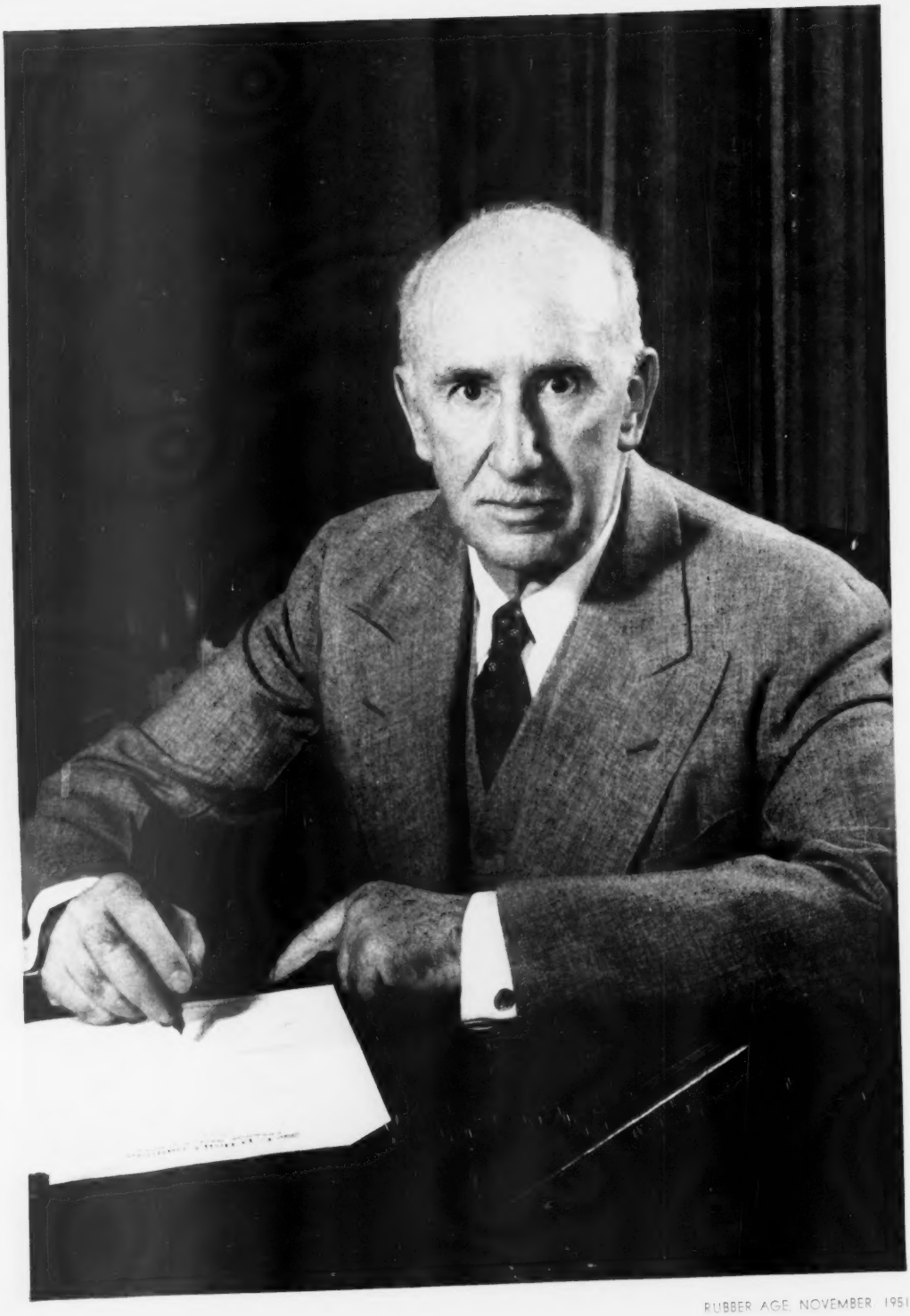

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November 22, 1951

To our Customers:

The Thanksgiving Season reminds us of the part you have played in making our past year a happy and successful one. Your continued trust and loyal friendship mean much to us. We are duly thankful.

We sincerely appreciate the business which you have given us and trust that we have maintained the high standards of service to which we aspire and that all your dealings with us have been to your entire satisfaction. Please be assured that we shall continue to endeavor to merit your confidence and good will.

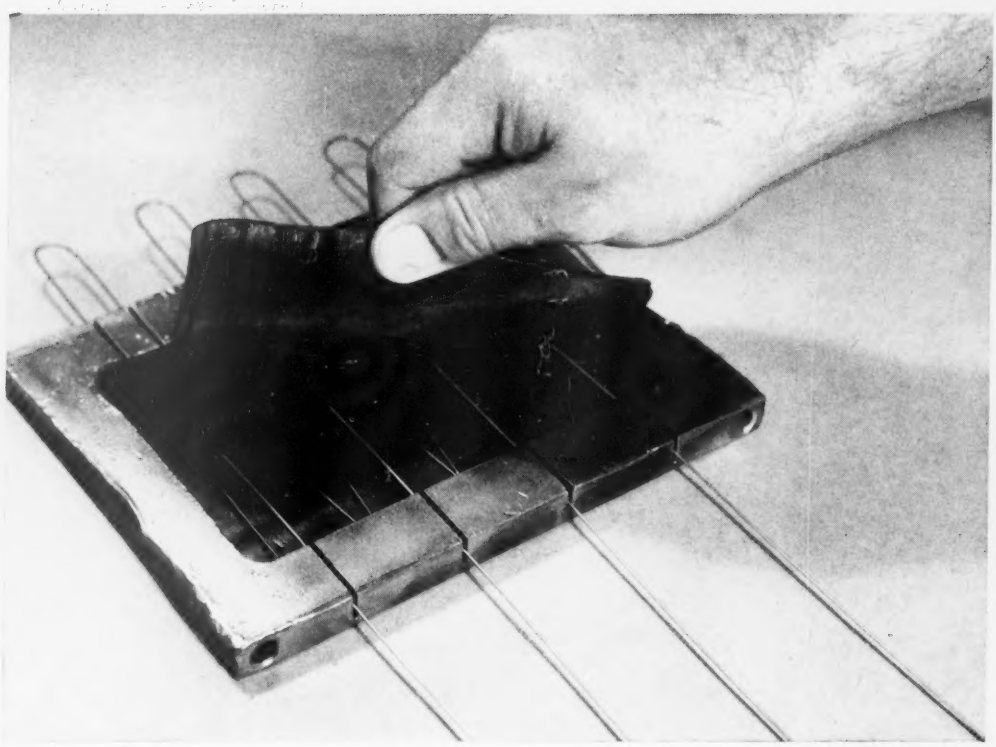
Thanking you again for your interest and support and extending our sincere wishes for your enduring success and prosperity, we remain

Very sincerely yours,

THE C. P. HALL COMPANY

CPH/h

President



How we use pull...

to help your wire do a better job!

● It doesn't pay to take things for granted. That's why extensive wire research goes on *all* the time at National-Standard — behind-the-scenes work that time and again helps our customers speed operations, save material, improve their products and cut costs.

The lab test being rigged above, for example, will reveal the rubber adhesion qualities of a newly developed wire finish. After the rubber layers are vulcanized, carefully recorded pull will be exerted on the imbedded wire until it finally breaks loose. Only by such painstaking test work can you be assured of new, improved qualities and characteristics that will let you make the *most* of wire.

Whatever use you make of wire—in rubber products, or anything from bottle caps to zither strings —keep in mind that National-Standard's facilities, experience and "groundwork" are always ready to help you put wire to work with the *greatest* efficiency at the *lowest* cost.

NS NATIONAL-STANDARD Company NILES, MICHIGAN

DIVISIONS OF NATIONAL-STANDARD CO.

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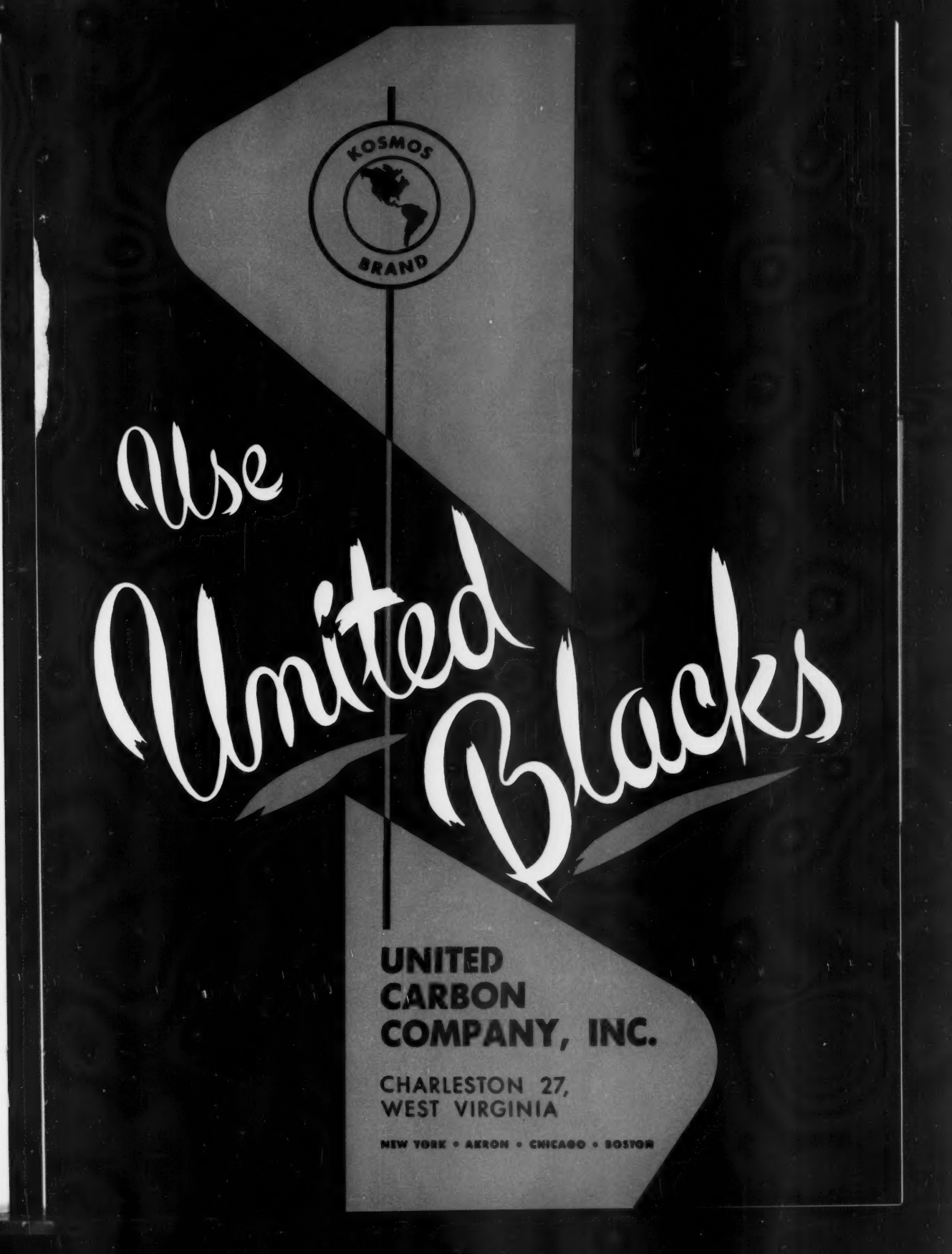
WORCESTER WIRE WORKS..*Worcester, Mass.*	Round and Shaped Steel Wire, Small Sizes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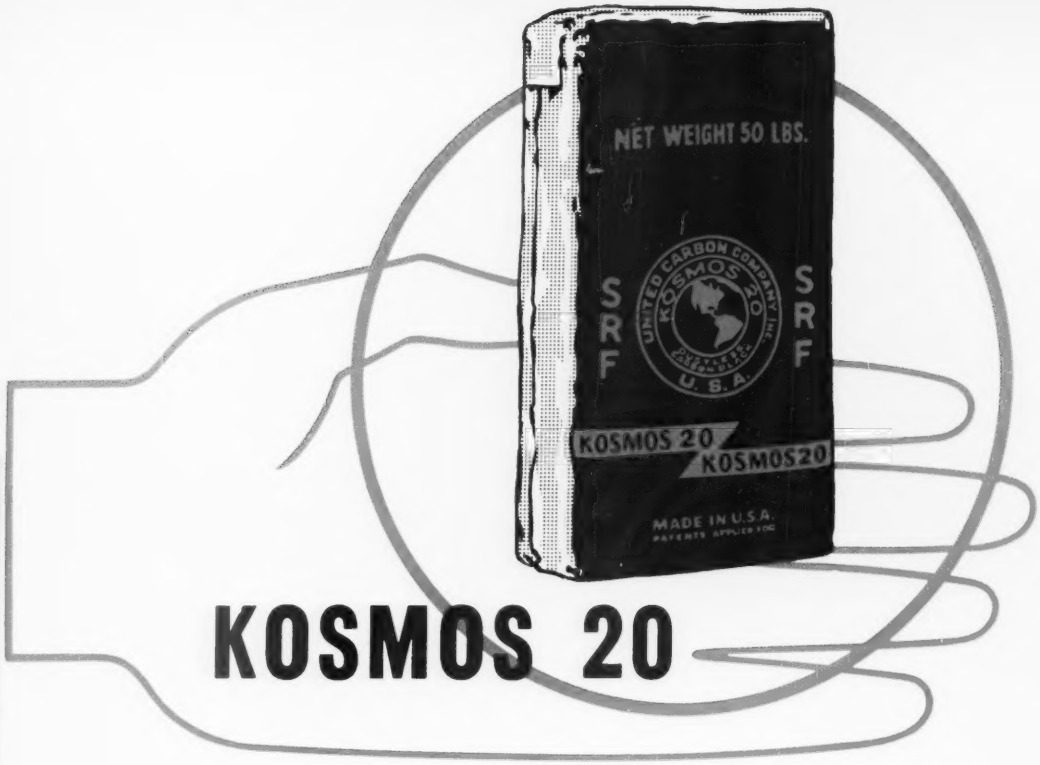

KOSMOS 20

at hand...

the qualities you need!

It is easier to stay in the lead when you standardize on United Blacks. For example, KOSMOS 20 . . . an SRF black with extensive applications in the rubber industry. It is a black of dependable uniformity, outstanding for ease of processing, good plasticity and fast rate of cure. For maximum efficiency use KOSMOS 20.

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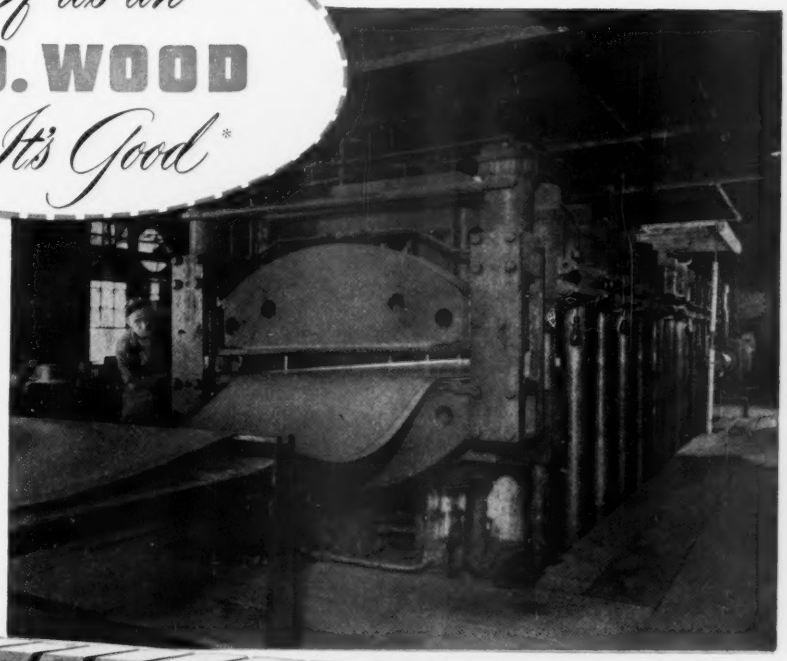
CANADA: CANADIAN INDUSTRIES, LIMITED

If it's an

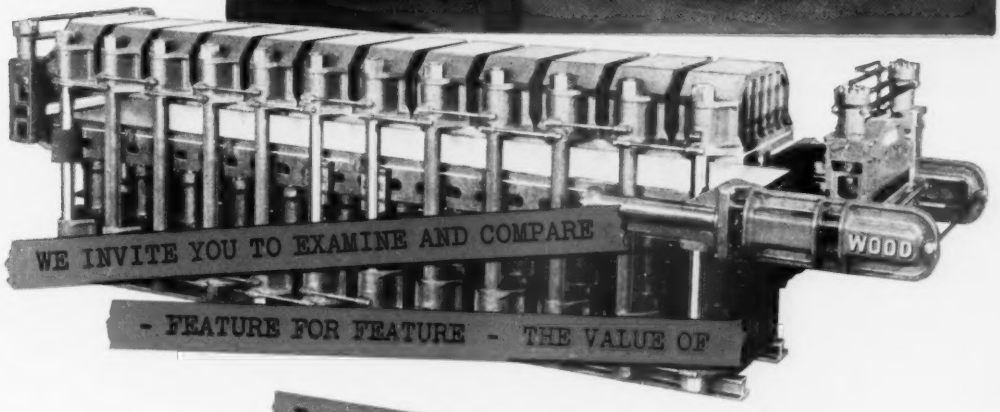
R.D. WOOD

*...It's Good**



3,180-ton single opening hydraulic belt press used for vulcanizing rubber belting. Twenty-four cylinders are arranged in pairs which can be cut out at any time, or can be removed from the press without dismantling any other part.

Hydraulic stretcher and clamping units are mounted at the ends of the moving platen which measures 63¼" x 30' x 3¾".



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HYDRAULIC PRESSES AND VALVES FOR EVERY PURPOSE
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Established 1803

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*FIND OUT WHY. SEND FOR YOUR FREE COPY OF OUR NEW PHOTOGRAPHIC BOOK OF PLANT FACILITIES.

a LITTLE goes a long way....

Marbon "8000"

Look what Marbon "8000" can do for your rubber compounds

- *Elimination of Masterbatching.*
- *Plasticizing action at processing temperatures.*
- *Lower power consumption on highly loaded stocks.*
- *Versatility with natural, synthetic and reclaim rubbers.*
- *Higher unit reinforcement.*

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It BLENDS as it STRENGTHENS as it IMPROVES

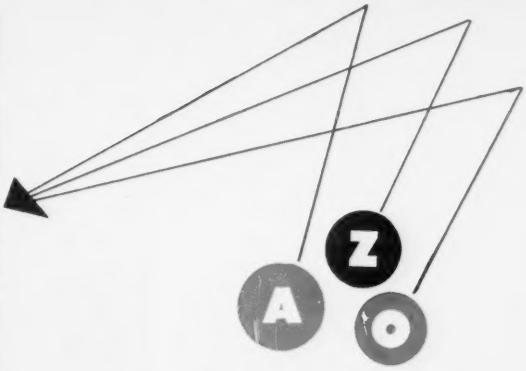
AZO-ZZZ-55

zinc oxide

An easy processing zinc oxide. Uniform particle size and absence of extreme "fines" assures good dispersion in rubber.

AZO

zinc oxides for every rubber need



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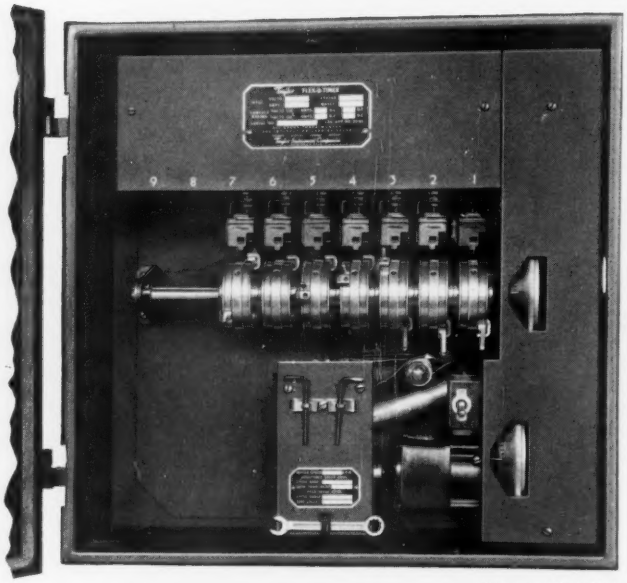
4 NEW ADVANTAGES IN FLEX-O-TIMER*

Time Cycle Controllers

ONE OF 5 STANDARD TAYLOR MODELS RE-DESIGNED FOR GREATER ADAPTABILITY



YES, we've completely re-designed the famous Taylor Flex-O-Timers. Result—a whole new family of Taylor Time Cycle Controllers precision built to meet your strictest processing requirements! For instance, you get these four big advantages:

1. **Greater Flexibility.** Wide range of cycle bands from 11 seconds to 540 minutes available to meet all time cycle controller requirements. Cycle duration may be either fixed or varied. Up to 18 control functions may be contained in one instrument.

2. **Newly Designed, Segmented Drum.** Individual aluminum segments mounted on a central shaft. One segment for each control function. Provision for number of actuating pins needed to operate a function as many as 15 times. Readily interchangeable cycle drum assemblies enable you to preset cycles for applications where components within cycle vary periodically.

3. **Unit Parts Easier to Reach.** Universal dust-tight case has hinged door with bayonet-action latch. All unit assemblies front-mounted—easy to reach when you open door. Thus, terminal strips, air valves and switches, snap-operators, cycle drum, solenoid motor and gear train can be easily removed for repair or replacement. Terminals, control functions and gears are all plainly numbered so that connections or gear train changes can be made in the field.

4. **Easier and Simpler Adjustments.** Actuating pins of precision die-cast aluminum are easy to remove and set. Fingertip adjustment of speed dial gives a range of adjustments of 80 to 1.

Of course, the Flex-O-Timer shown here is just one of the family!

(1) It controls a group of as many as 9 pneumatic or 9 electrical functions (or any combination of each)—with all the intermediate steps within a function automatically controlled for the duration of the manufacturing operation. Particularly adaptable for such applications as *tire presses or horizontal and vertical vulcanizers.*

* Registered Trade-Mark

Meet the other members, too!

(2) The 10 to 18 function Flex-O-Timer for complex control according to a predetermined schedule and over a specifically timed period. Perfect for such applications as *horizontal and vertical vulcanizers.*

(3) The 1 to 5 function Flex-O-Timer for simpler applications like *belt presses, mechanical rubber products presses* or *tire presses.*

(4) The 1 to 3 function Flex-O-Timer—specifically developed for *tube molding* presses.

(5) The single function Flex-O-Timer . . . particularly useful for *condensate removal* applications.

• • •

Write today for the new Taylor Catalog 98154. It tells the whole new and improved Flex-O-Timer story. Just one more way we're ready to help you keep quality up and costs down with Taylor Accuracy. Taylor Instrument Companies, Rochester, New York, and Toronto, Canada. *Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.*

TAYLOR INSTRUMENTS MEAN ACCURACY FIRST

Eliminate Loss from SCORCHED STOCKS

Recover with SYNTHOL

FOR SYNTHETIC RECLAIM AND NATURAL RUBBERS

"BRING BACK" scorched stocks? Yes, SYNTHOL will do this and more, too, because it acts both as a tackifier and a plasticizer in all types of compounds. Even ground cured scrap, if not too dry, can be plasticized with SYNTHOL and remolded for practical use in many mechanical articles. SYNTHOL cuts milling costs by speeding up breakdown and dispersion of pigments. Smooth, tacky, nerveless, easy spreading stocks result. In formulating cement stocks SYNTHOL will work to your advantage in building tack and high solids. Try a sample—write for it today and prove what SYNTHOL can do for you.

AVAILABLE IN DRUMS, HALF DRUMS AND QUARTER DRUMS

Made by the Makers of **GLYCERIZED LUBRICANT** *and* **RUBBEROL**

QUALITY SINCE 1884

GENSEKE BROTHERS

RUBBER MATERIALS DIVISION

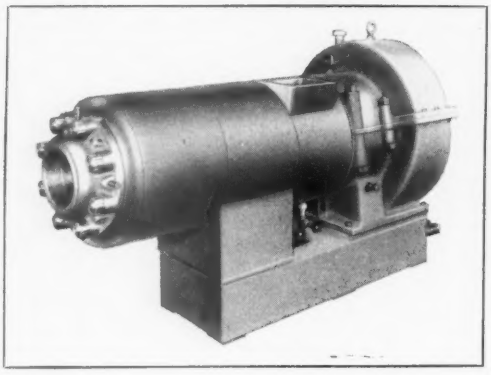
West 48th Place and Whipple Street Chicago 32, U.S.A.

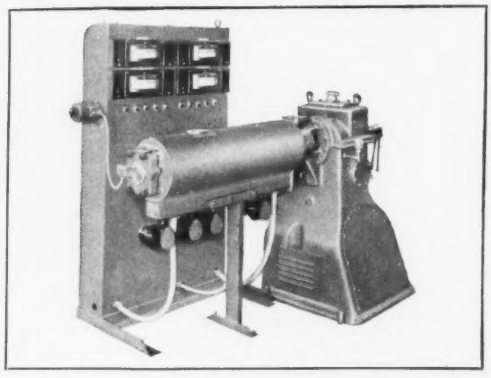
PROCESSING MACHINERY BULLETIN

Reporting News and Machine Design Developments

IN BUSINESS TO **NRM** REDUCE YOUR COSTS

CUT MIXING COSTS WITH NRM'S NEW CONTINUOUS MIXING EXTRUDERS





MIL-X-TRUDER

eliminates warm-up mill

Many materials that have been difficult to mix and extrude now can be handled continuously by the new NRM Mil-X-Truder. Special NRM construction features permit internal recirculation of material passing through the Mil-X-Truder. This means added mixing for "hard to mix" stocks, the elimination of warm-up mills on standard stocks, plus savings in floor space, labor and maintenance.

Stocks can be fed into the NRM Mil-X-Truder in pelletized or strip form. Sticky and asbestos loaded materials can be extruded with accuracy, powders can be compacted and natural and synthetic rubbers can be mixed and extruded without the use of a warm-up mill.

STRAINING

If you strain foreign matter from rubber or plastic compounds, investigate the new NRM Mil-Strainer. The Mil-Strainer is a Mil-X-Truder equipped with NRM's new Quick-Opening strainer head and Flared Head Screw.

TWO-STAGE EXTRUDER

eliminates initial compounding and drying

Now you can stop paying premium prices for special short order compounds. With the new NRM Two-Stage Extruder compounds can be quickly mixed in your own plant from a simplified inventory of basic materials.

The NRM Two-Stage Extruder, the first single screw extruder to incorporate colloiding, devolatizing and extruding, eliminates initial compounding and drying of compounds. In one operation the NRM Two-Stage Extruder mixes, dries and extrudes pre-blended wet acetate, acrylic and polystyrene compounds to be pelletized directly at the die or in a chopper. It will pay you to investigate the NRM Two-Stage Extruder.

Substantial savings in production time can be realized, shorter deliveries can be quoted, inventory can be reduced and reliance on outside sources for compounds can be avoided. There's an NRM Two-Stage Extruder to meet your requirements.

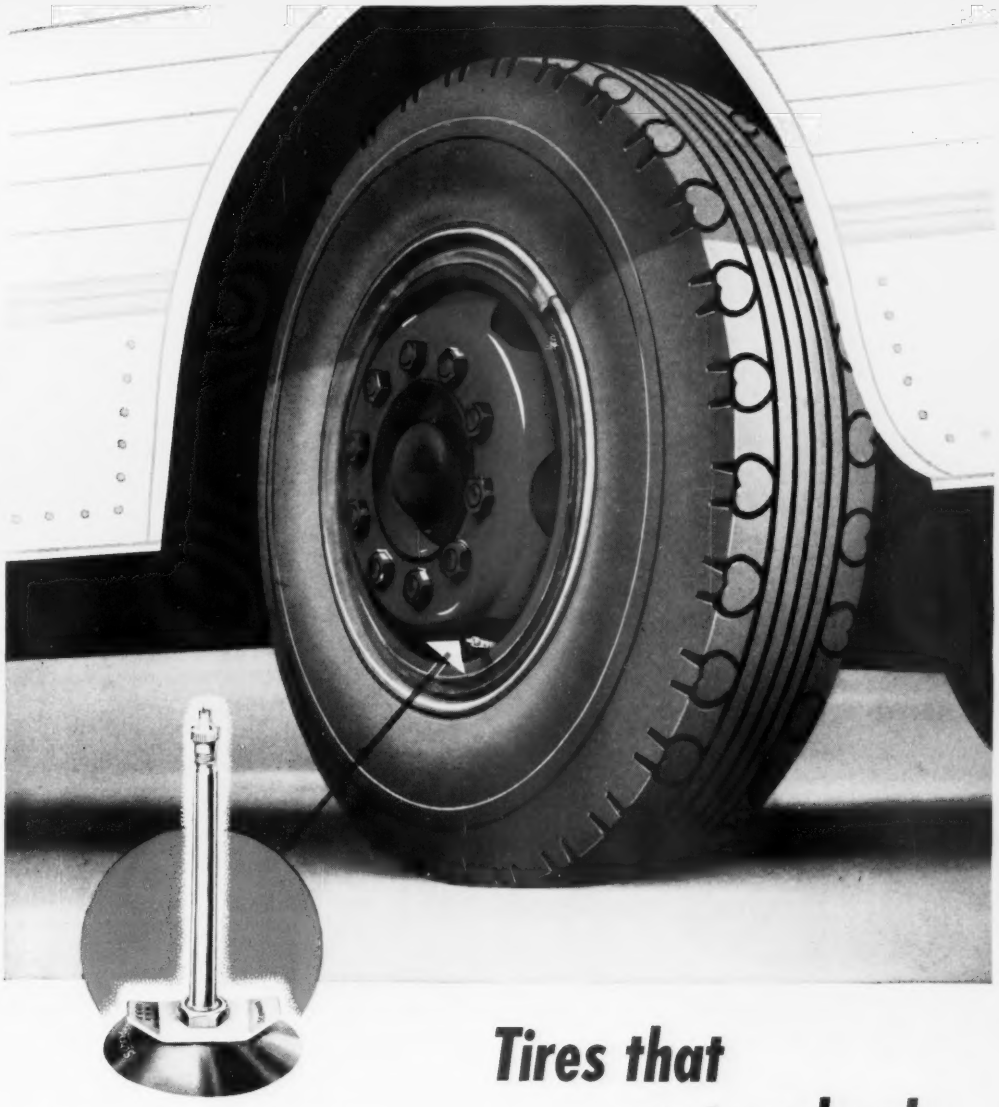
WRITE FOR COMPLETE DETAILS

NATIONAL RUBBER MACHINERY CO. General Offices & Engineering Laboratories Akron 8, Ohio

PLANTS at Akron and Columbiana, Ohio and Clifton, N. J.

AGENTS East: National Rubber Machinery Co., Clifton, N. J.
West: S. M. Kipp, Box 441, Pasadena 18, Calif.

Creative Engineering



Tires that go to school

Buses carry kids to school; make trips to town easier for the housewife; make cross-continent transportation inexpensive, fast. Their payload depends on top notch pneumatic tires. And vital to tire economy and safety is the valve that *locks* the air in the tire.

Schrader . . . the top valve producer . . . works with and for all tire manufacturers in continuing research and development. Schrader backs product leadership with production capacity—capacity that provides the major source of supply for rubber manufacturers.

A. SCHRADER'S SON, BROOKLYN 17, N. Y.
Division of Scovill Manufacturing Company, Incorporated

Schrader
REG. U. S. PAT. OFF

FIRST NAME IN TIRE VALVES
FOR ORIGINAL EQUIPMENT AND REPLACEMENT

How to tell *quality* in brushes ...just look for "OSBORN"

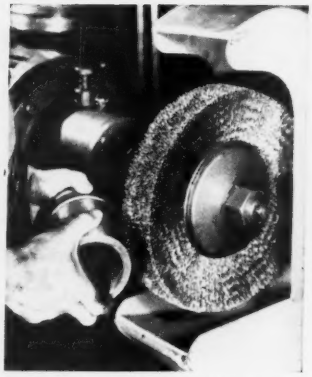
IT is easy to buy good industrial brushes. Just specify "OSBORN" and order them automatically from your Industrial Distributor along with other mill supplies. You are sure to get the best in workmanship and materials. Osborn brushing tools are backed by 59 years of service to industry throughout the world.

Write for handy pocket catalog. *The Osborn Manufacturing Company, Dept. 574, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

*Trade Mark

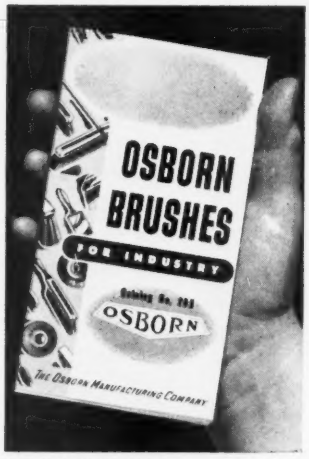
OSBORN

LOOK FOR THE NAME OSBORN . . . RECOGNIZED EVERYWHERE FOR QUALITY WORKMANSHIP AND MATERIALS

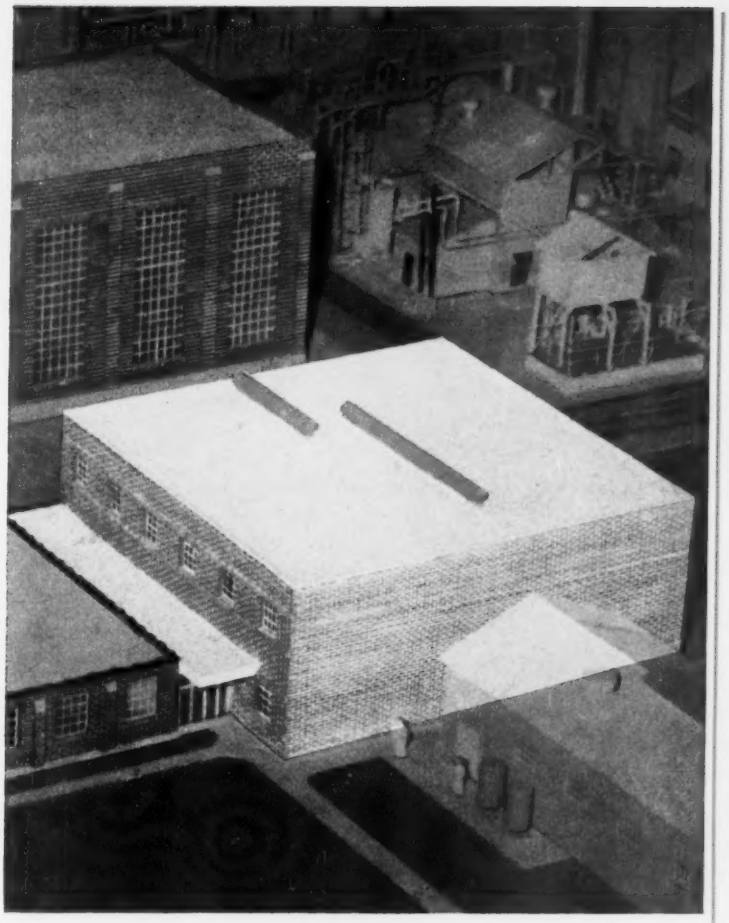


SIMPLIFIES CLEANING. Osborn power brushes efficiently remove scale, rust, grit, old paint, prepare surfaces for welding . . . deburr metal parts . . . rough up rubber. Built for manual or automatic operation in a wide range of types, sizes and fill materials.

BUILT FOR INDUSTRY by the company that knows Industry's problems, OSBORN Master* Sweep Floor Brushes and other maintenance brushes are designed to do your jobs better—faster.



FREE HANDY CATALOG.....Describes OSBORN maintenance brushes for every industrial need. Handy pocket size. Write for your free copy.



RUBBER CHEMICALS LABORATORY addition at Monsanto's Nitro, West Virginia, plant as it will appear when completed next year.

Monsanto expands rubber research

Monsanto, a leader in rubber chemicals research for three decades, is extending its activities in this field with the construction of a substantial addition to its laboratories in Nitro, West Virginia. The new facilities, which will be in operation in 1952, will more than double space in its rubber research laboratories in Nitro and in Akron, Ohio. The number of scientists and technicians employed in the laboratories will be substantially increased.

Monsanto research has made regular important contributions to rubber progress in the last 30 years, including developments of value in processing of natural, synthetic and reclaimed rubber.

Research facilities of Monsanto are available to the rubber industry. If you have a problem in rubber compounding or rubber research, we hope you will feel free to discuss it with us. For further information, get in touch with MONSANTO CHEMICAL COMPANY, Rubber Service Department, 920 Brown Street, Akron 11, Ohio.

MONSANTO CHEMICALS FOR THE RUBBER INDUSTRY

Antioxidants
Flectol* H
Santoflex* B
Santoflex BX
Santoflex 35
Santoflex AW
Santowhite* Crystals
Santowhite MK
Santowhite L

Aldehyde Amine Accelerators
A-32
A-77*
A-100

Mercapto Accelerators
Santocure*
El-Sixty*
Ureka* C
Ureka Base
Mertax (Purified Thiotax)
Thiotax (2-Mercapto benzothiazole)
Thiofide* (2,2′ dithio-bis benzothiazole)

Guanidine Accelerators
Diphenyl Guanidine (D.P.G.)
Guantal*

Ultra Accelerators for Latex, Etc.
R-2 Crystals
Pip-Pip
Thiurad* (Tetra methyl thiuram disulfide)
Ethyl Thiurad (Tetra ethyl thiuram disulfide)
Mono Thiurad (Tetra methyl thiuram mono sulfide)
Methasan* (Zinc salt of dimethyl dithiocarbamic acid)
Ethasan* (Zinc salt of diethyl dithiocarbamic acid)
Butasan* (Zinc salt of dibutyl dithiocarbamic acid)

Wetting Agents and Detergents
Areskap* 50
Aresklene* 375
Santomerse* S
Santomerse D

Special Materials
Thiocarbanilide ("A-1")
Santovar*-A
Santovar-O
Insoluble Sulfur "60"
Retarder ASA

Colors

Reodorants

*Reg. U. S. Pat. Off.

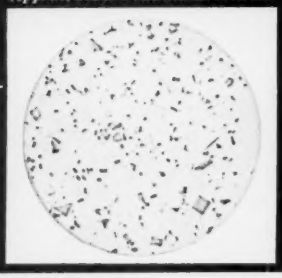
MONSANTO
CHEMICALS – PLASTICS

SERVING INDUSTRY... WHICH SERVES MANKIND

for high quality

RUBBER PRODUCTS

Magnification 1500X
Approx. Scale: 1 Micron = 1/16 in.



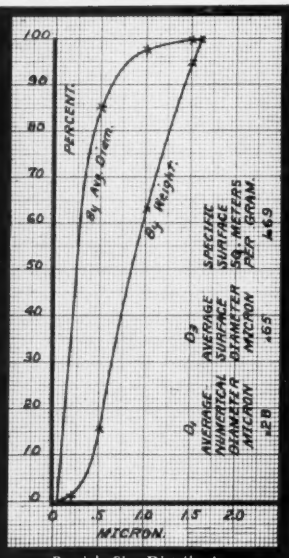
ST. JOE GREEN LABEL #42

Representative Chemical Tests

ZnO	99.20%
Pb	.03
Cd	.01
Mn	.003
Cu	.002
Acidity as SO_3	.03
Total S as SO_3	.05
H_2O soluble salts	.15
Insoluble in HCl	.15
Loss at 110° C.	.30

Representative Physical Tests

Particle size	
Average numerical diameter D_1 — microns	.28
Average surface diameter D_2—microns	.65
Specific surface—Sq.M./gram	1.69
Percent fines under .50 micron	16.0
Specific gravity	5.65
Apparent density—lb./cu. ft.	30.
Cleanliness	
Percent thru 325 mesh screen	99.97



Particle Size Distribution

ST. JOSEPH LEAD COMPANY

250 PARK AVE.
NEW YORK CITY 17

Plant & Laboratory: Monaca (Josephtown) Pa.

In the group of St. Joe fast curing zinc oxides, **Green Label #42** has long been preferred by many manufacturers of high quality rubber products. Some of the reasons for this preference — in addition to its excellent activating and reinforcing properties — are its rapid incorporation into rubber, combined with ease and completeness of dispersion.

Complete physical and chemical properties of St. Joe rubber grade zinc oxides are described in our new technical manual, ST. JOE ZINC OXIDES. Write for your free copy—on your company letterhead please.

For distinguished service...

PHILLIPS PETROLEUM COMPANY is proud to receive the 1951 Chemical Engineering Achievement Award for having:—

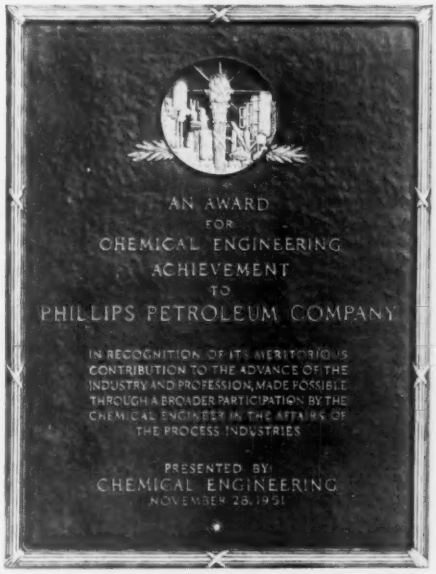
"... contributed most to the advance of chemical engineering in industry..."

Seventy of the nation's leading chemical engineering authorities independently voted this honor to Phillips for a two-fold achievement: First, Phillips development of high abrasion carbon black; second, Phillips major contribution to the success of cold synthetic rubber. Together these advances make possible automobile tires that wear thousands of miles longer than the finest tires ever made before.

Credit for this success goes to those who make chemical dreams come true in our laboratories and plants. Over 2,000 of our nearly 20,000 employees are scientists and engineers. From their diversified efforts come achievements without number across the whole broad field of petroleum chemistry.

We work vigorously with nitrogen fertilizers, atomic energy, sulfur compounds, synthetic fiber materials and many organic chemicals. And, of course, we are in our third decade as large producers, refiners and marketers of fuels and lubricants.

Previously this award has recognized such great endeavors as the Atomic Bomb Project and the war-time Synthetic Rubber Industry.


AN AWARD
FOR
CHEMICAL ENGINEERING
ACHIEVEMENT
TO
PHILLIPS PETROLEUM COMPANY
IN RECOGNITION OF ITS MERITORIOUS CONTRIBUTION TO THE ADVANCE OF THE INDUSTRY AND PROFESSION, MADE POSSIBLE THROUGH A BROADER PARTICIPATION BY THE CHEMICAL ENGINEER IN THE AFFAIRS OF THE PROCESS INDUSTRIES
PRESENTED BY
CHEMICAL ENGINEERING
NOVEMBER 28, 1951

It is a privilege for us to be honored with these groups and with the other important chemical companies which have also earned this high distinction for outstanding chemical engineering accomplishments.

WHAT THIS ACHIEVEMENT MEANS TO YOU...

For every 9,000 miles you drive your car, the average wear is about $\frac{1}{8}$th of an inch from the tread of natural rubber tires made with ordinary carbon black.

Now, with tires made with *Philblack O* high abrasion carbon black* and *cold rubber*, the same $\frac{1}{8}$th inch of tread wear will give you 12,000 . . . 13,000 . . . even 14,000 miles of good, safe service.

*A Trademark

Phillips 66

PHILLIPS PETROLEUM COMPANY

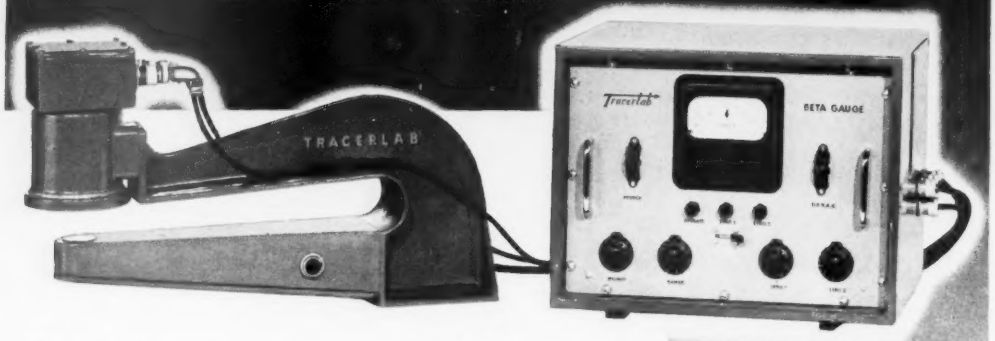
Phillips Chemical Company, a subsidiary

Bartlesville, Oklahoma

THICKNESS CONTROL A PROBLEM?

Tracerlab Beta Gauges

CUT COSTS—IMPROVE QUALITY



TRACERLAB's new model, non-contacting Beta Gauge measures and records the weight per unit area or thickness of sheet materials. Because beta radiation is used, a high degree of accuracy and sensitivity is achieved, unaffected by variations in chemical composition of the material being gauged.

Tracerlab developed the first Beta Gauges, and the experience gained through having these instruments in successful, everyday operation in a number of diversified process industries has now been incorporated in a new and outstanding gauge. Featured are simplicity of operation, ruggedness of design and reliability of operation — all combined in an instrument that maintains Tracerlab's established leadership.

The gauge's low cost will be rapidly repaid from raw material savings resulting from closer manufacturing tolerances and faster control, plus a greater uniformity of product with its resulting advantages. A meter showing percentage variation from normal, or a meter calibrated directly in weight or thickness, is standard equipment. Where a continuous record is desired, various types of recorders are available.

For non-contacting gauging of materials accessible only from one side, Tracerlab manufactures a model which operates by measuring "back scattered" beta particles. This gauge is particularly useful in gauging rubber, paper, plastics and other materials as they pass over a calender roll. It has also proved highly effective in measuring thickness of coatings on certain substances.

For complete information, write for Bulletin BG-RA.

Tracerlab
BETA GAUGES
are *NOW* gauging:

CARDBOARD
•
PLASTICS
•
PAPER
•
ADHESIVE TAPE
•
SHEET METAL
•
RUBBER
•
PAPER COATINGS
•
METAL FOIL
•
PLASTIC COATINGS
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PHOTOGRAPHIC COATINGS
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LINOLEUM

Tracerlab

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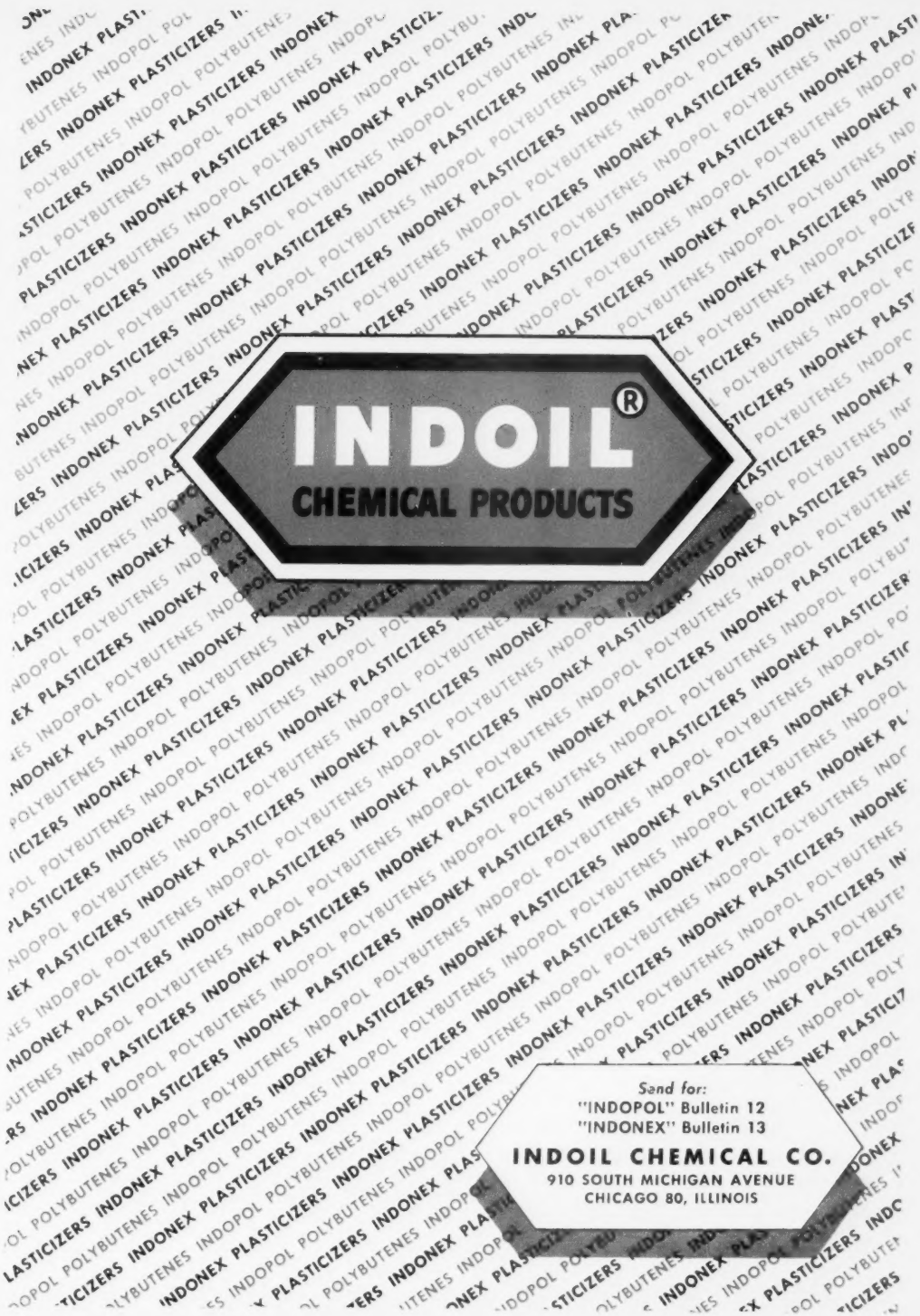
TRACERLAB INC., 130 HIGH STREET, BOSTON 10, MASS.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"INDONEX" Bulletin 13
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910 SOUTH MICHIGAN AVENUE
CHICAGO 80, ILLINOIS

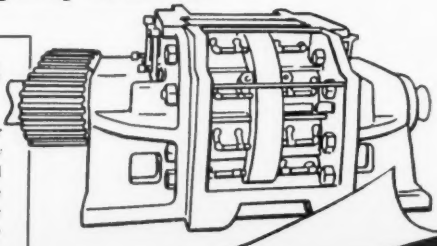
Memo:

write Interstate for details of how "pre-plan" Banbury rebuilding will save more production time

ENTRUST your valuable Banbury mixer body only to qualified veterans and specialists in Banbury rebuilding. Interstate Service has been perfected through more than sixteen years of experience. Our facilities handle every size and type of Banbury and each job is guaranteed. Estimates gladly furnished.

SPARE BODIES AND PARTS

We have for sale or interchange Banbury bodies in both spray and jacketed types, and we can also supply parts for most sizes. Tell us your requirements.



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EXCLUSIVE SPECIALISTS IN BANBURY MIXER REBUILDING

INTERSTATE WELDING SERVICE

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from OUR PLANT to YOURS

Behind Neville's quality of production is a distribution system that goes hand in hand with its expanding manufacturing facilities. With main plant located in the heart of the industrial East and with a branch plant in fast-growing Southern California, Neville customers are assured the fastest possible service, whether the order leaves the plants in drums, tank-transports or by tank-car!

THE NEVILLE COMPANY NEVILLE **PITTSBURGH 25, PA.**

Plants at Neville Island, Pa., and Anaheim, Cal.

RESINS—COUMARONE INDENE • MODIFIED COUMARONE INDENE • PETROLEUM • ALKYLATED PHENOLS
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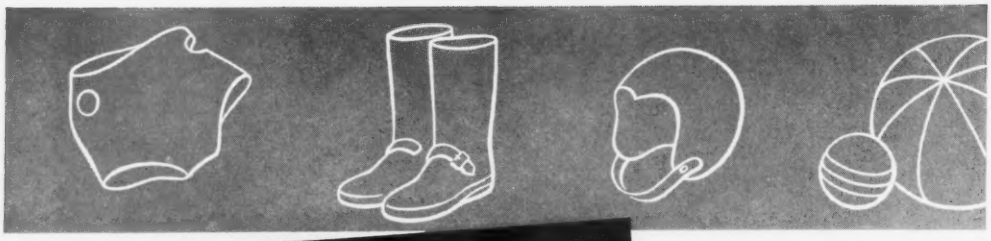
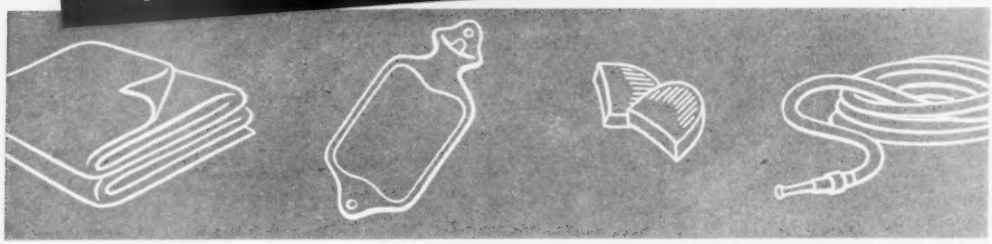
SPECIALTIES—PHENOTHIAZINE • RUBBER COMPOUNDING MATERIALS • TAR PAINTS

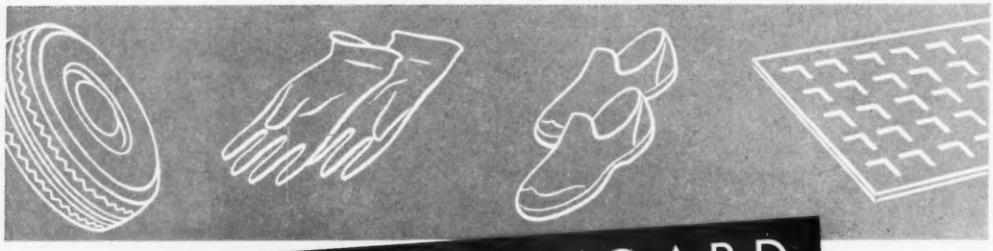
A-41



TITANOX *means*



whiter...brighter rubber products



ACROSS THE BOARD

The pure titanium dioxide pigments, TITANOX-A and TITANOX-RA assure whiter whites and brighter color tints with minimum loadings, thus maintaining the desirable characteristics of your product. TITANOX-RA-NC is advantageous in compounds which are exposed to sunlight and the weather. TITANOX-RCHT (rutile-calcium pigment) is preferred for economical whiteness and brightness in more heavily loaded stocks. Its finely divided pigment and extender promote normal aging and resist discoloration.

Our Technical Service Department is ready at any time to discuss your individual rubber pigmentation problems with you. Titanium Pigment Corporation, 111 Broadway, New York 6, N.Y.; Boston 6; Chicago 3; Cleveland 15; Los Angeles 22; Philadelphia 3; Pittsburgh 12; Portland 9, Ore.; San Francisco 7. In Canada: Canadian Titanium Pigments, Ltd., Montreal 2; Toronto 1.

8970

TITANOX

the brightest name in pigments

TITANIUM PIGMENT CORPORATION

Subsidiary of NATIONAL LEAD COMPANY

You're on the *Right Course* with Dependable PX Plasticizers!

The jobs for plastics are growing—and growing *tougher*—every day! The military, for example, is using dozens of new products made of versatile vinyl plastics—products which must take a regular diet of heat, cold, abrasion or constant flexing.

To a large degree it's the *plasticizer* that makes these articles so durable and useful. That's why manufacturers demand plasticizers of uniform maximum quality . . . an advantage they're assured of when they specify Pittsburgh PX Plasticizers.

As a basic and integrated producer of coal chemicals—benzene, xylene, pyridine and phthalic anhydride, to name just a few—we're able to control and maintain the high quality of our plasticizers from coal to finished product. And that means better performance and ease of use in your formulations.

Whether you're considering plasticizers—or the basic products of our other integrated divisions—remember that the Pittsburgh name and trademark stand first and foremost for *reliability*.

PX-104 ——— DiButyl Phthalate
PX-108 ——— DiIsoOctyl Phthalate
PX-138 ——— DiOctyl Phthalate
PX-228 ——— DiIsoOctyl Adipate
PX-410 ——— DiButyl Sebacate
PX-808 ——— DiIsoOctyl Sebacate
PX-659 ——— TetraHydroFurfuryl Oleate
PX-912 ——— TriCresyl Phosphate

W&D 3886

PLASTICIZER DIVISION
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There's an easier way to separate SHEET or SLAB stock and lots healthier, too!

"AQUAZINC" IS YOUR ANSWER!

Using elephants to pull sheeted stock apart would be novel — but using Aquazinc to *keep* it apart is lots smarter! Highly concentrated zinc stearate solution — Aquazinc is applied as a spray or dip — eliminating the health and explosion hazards of dusting — the need for liners or cushions. Developed especially for sheet-mill or slabbed stock, Aquazinc lubricates too, giving you a smooth-flowing stock plus perfect tack control. It is readily absorbed, without affecting the stock — leaves a glossy, non-greasy finish that adds appearance-appeal. Let us send a sample of Aquazinc to try in your own plant.

BEACON

PURITY · UNIFORMITY · DEPENDABILITY

Chemical Industries, Inc.

BOSTON 30, MASSACHUSETTS

SUNDEX-53 and CIRCOSOL-2XH

REVEALED AS THE OILS USED TO MAKE MORE RUBBER AVAILABLE

Rubber technologists recently discovered ways to greatly extend the supply of synthetic rubber by adding certain petroleum derivatives, in substantial quantities, to high-Mooney-viscosity polymers. In both the experimental work and plant production to date, Sundex-53 and Circosol-2XH have played vital roles. This significant fact is disclosed in recently published reports about the revolutionary processes. Following are two noteworthy extracts . . .

". . . Of the various oils tested, Sundex-53 and Circosol-2XH were both satisfactory plasticizers, and both have low volatility. These two oils were used in most of the work . . . One of the early questions was whether or not oils would be removed by heat from the plasticized high-viscosity rubbers. Experiments were accordingly designed to find oils which would be relatively non-volatile . . . It is apparent that two of these oils, Sundex-53 and Circosol-2XH, showed relatively low volatility under the test conditions."

Swart, G. H., Pfau, E. S., and Weinstock, K. V., "A Study of Plasticized High Mooney Viscosity Synthetic Rubbers," *India Rubber World*, June 1951.

"From February 21, 1951, when the oil-masterbatched GR-S (X-628) and oilblack masterbatched GR-S (X-629) were announced by RFC, until June 1, over 5 million pounds gross of X-628 and over 3 million pounds gross of X-629 were produced in the GR-S plant operated by Goodyear for RFC at Houston, Texas. The oil which has been used in these products to date is Circosol-2XH."

D'Lanni, J. D., Hoesly, J. J., and Greer, P. S., "Oil-Extended Synthetic Rubber, Including Oil-Masterbatched GR-S," *Rubber Age*, June 1951.

If you are processing any type of synthetic polymers it will pay you to run tests with Sundex-53 and Circosol-2XH. For specifications and typical formulations, write Dept. RA-8

SUN INDUSTRIAL PRODUCTS

SUN OIL COMPANY, PHILADELPHIA 3, PA. • SUN OIL COMPANY, LTD., TORONTO AND MONTREAL

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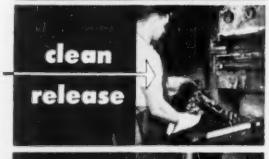

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Natural Rubber News

Published by the NATURAL RUBBER BUREAU

RUBBER GROWERS BATTLE REDS

MALAYAN WAR AGAINST COMMUNISTS IN 4TH YEAR

The Communists are losing a four-year-old battle for Malaya, chief source of the world's natural rubber.

Months of terrorism, murder and propaganda have failed to stem the flow of rubber to America, where today the world's largest stockpile of this strategic material is being built up for defense against Red aggression.

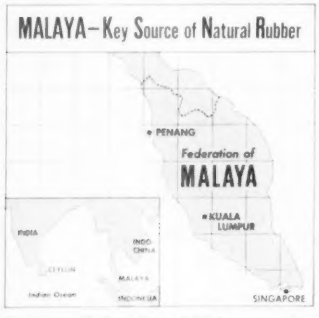
It has been a strange, nerve-wracking kind of warfare in Malaya. Red-trained bandits hide in the jungle, waiting for a chance to murder rubber planters, burn buildings, and destroy rubber trees. Frequent pitched battles occur — and there is the constant danger of a blast of machine gun fire from the edge of the jungle.

To date, one out of 30 rubber "estate" managers have been murdered, as well as hundreds of workers, by this unseen Red jungle army.

But the battle is being won. Today over 100,000 British and Malayan police and soldiers are tracking down this Red army, one by one, while guarding the rubber trees and the homes of the workers.

Malaya has proved itself a stronghold of democracy in Asia. Its people — predominantly Malays, Chinese and Indians — have resisted both Red bullets and Red bulletins. And in the face of these obstacles, they have produced the natural rubber needed by the free world — more rubber than ever before.

The people of Malaya look to America as their best customer and powerful champion in the fight for freedom in Asia.



The new Federation of Malaya consists of 9 States and 2 Settlements (Penang and Malacca). Kuala Lumpur, capital of Federation, is located in the heart of rubber country. Malaya's 3,500,000 acres of rubber trees, in 1950, produced 700,000 tons of natural rubber.

MALAY GUARD at entrance to rubber plantation is part of a force of 100,000 men fighting against the Communists in Malaya.

Research Aids 350,000 Malayan Rubber Farmers

The Rubber Research Institute of Malaya is a self-help operation, financed entirely by the rubber farmers themselves to develop better methods of growing and processing natural rubber.

At the Institute, soil types are tested, better yielding strains are developed through cross-breeding and bud-grafting, new insecticides and weedicides are studied, and experiments with new processes are carried out.

But the work of the Institute goes far beyond the realm of test tubes and pilot plants. All over Malaya, R. R. I. "extension" workers are busy helping the 350,000 small rubber farmers to improve their holdings.

Improves Quality Yield

The Institute makes available high-quality stock for budgrafting, so the farmer may improve the yield and quality of his future crop. Institute field men instruct farmers in better growing, tapping, and processing methods. They teach budgrafting and the art of tapping to schoolboys, who will someday be rubber farmers. R. R. I. men have aided, too, in setting up the rubber cooperatives which are today helping smallholders realize increased profits by selling to a central processing factory.

Malaya's Smallholders

The 350,000 independent Malayan smallholders have an average of 4 acres of rubber trees each. At present prices, these trees give them an average gross income, before all expenses of operation, of not over $900 (U. S. dollars) on which to support the average smallholder's family of five.

Manufacturers Double Rubber Use In Ten Years

Tribute to the creative skill and production prowess of the American rubber manufacturers is the fact that rubber use in the U. S. has nearly doubled every 10 years since 1900.

At the present rate, it is predicted that the United States will consume 1.8 million tons of new rubber in 1960 for tires, footwear, cushioning, industrial goods and hundreds of other products that add to the American standard of living.

Today the world rides, sits, sleeps and walks on rubber.

D. C. Gets Its First Natural Rubber Road

The nation's capital recently put down its first section of road paving incorporating natural rubber powder at Rock Creek Parkway and Constitution Avenue, in a heavily-traveled part of Washington.

The new natural rubber section is one of several experimental stretches which have been put down in the United States and Canada during the past two years.

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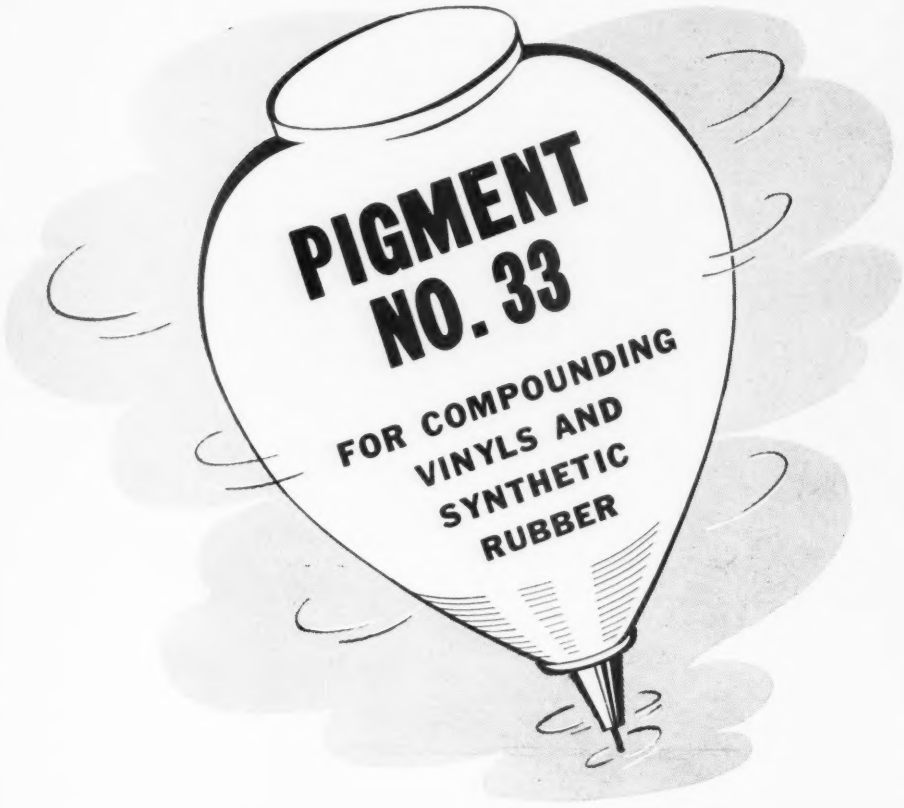

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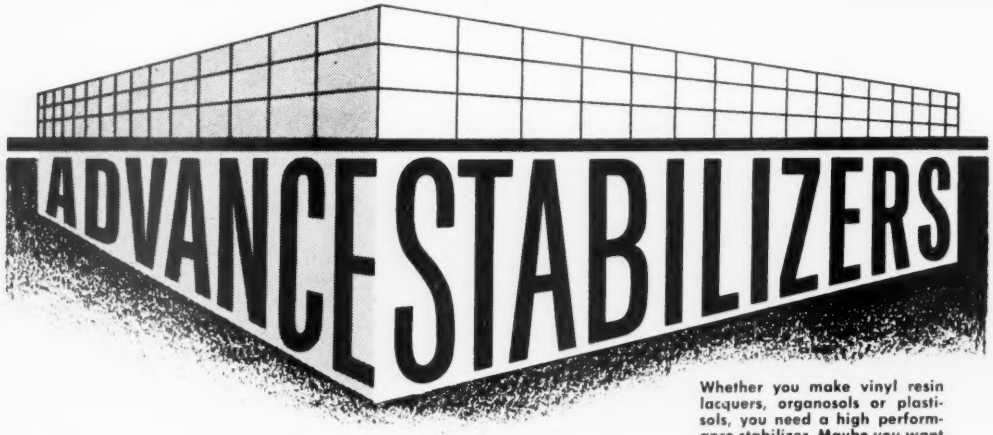

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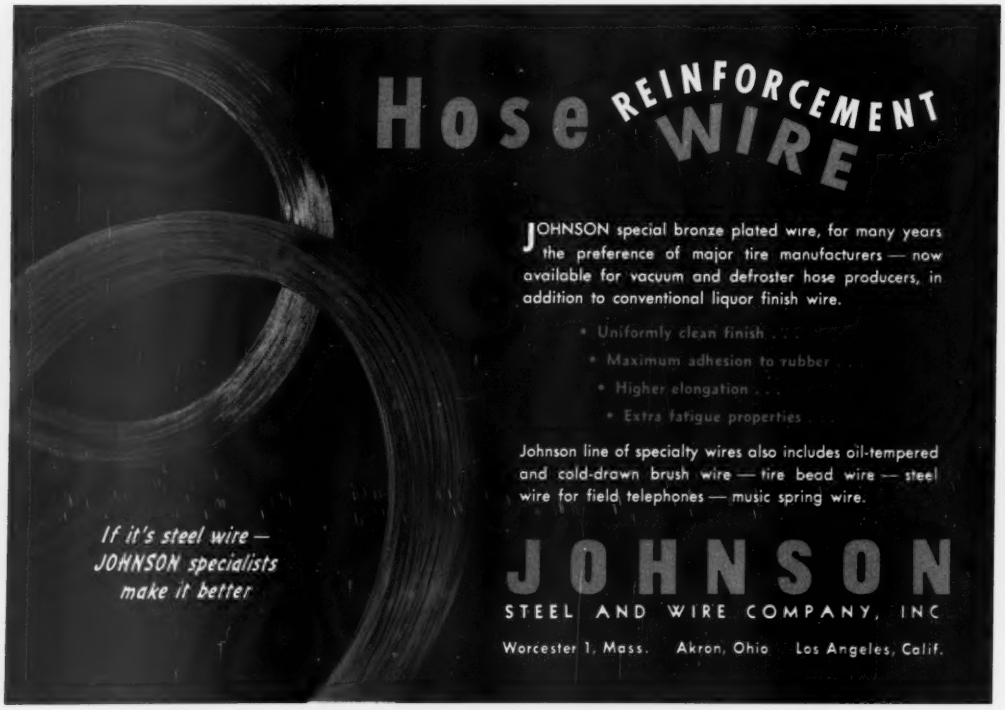
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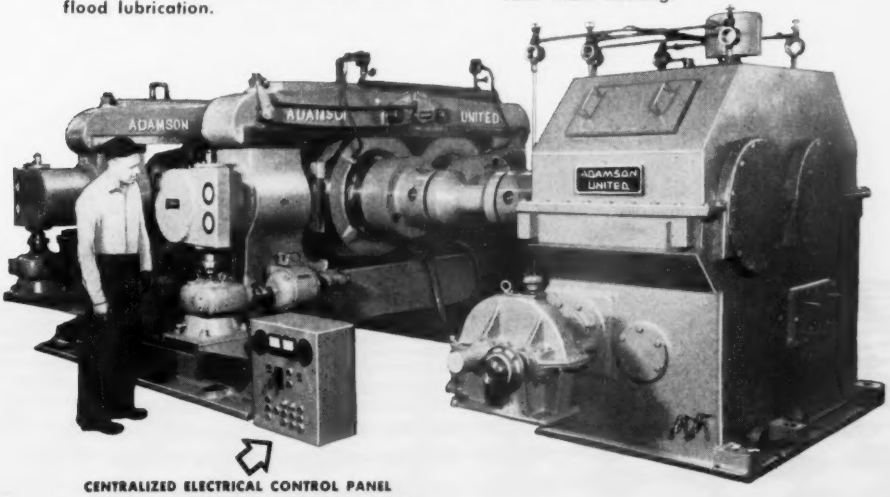

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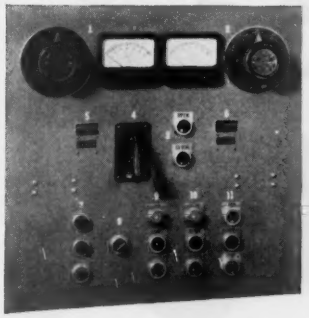

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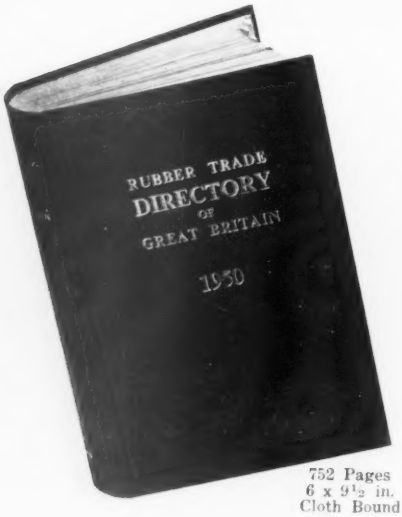

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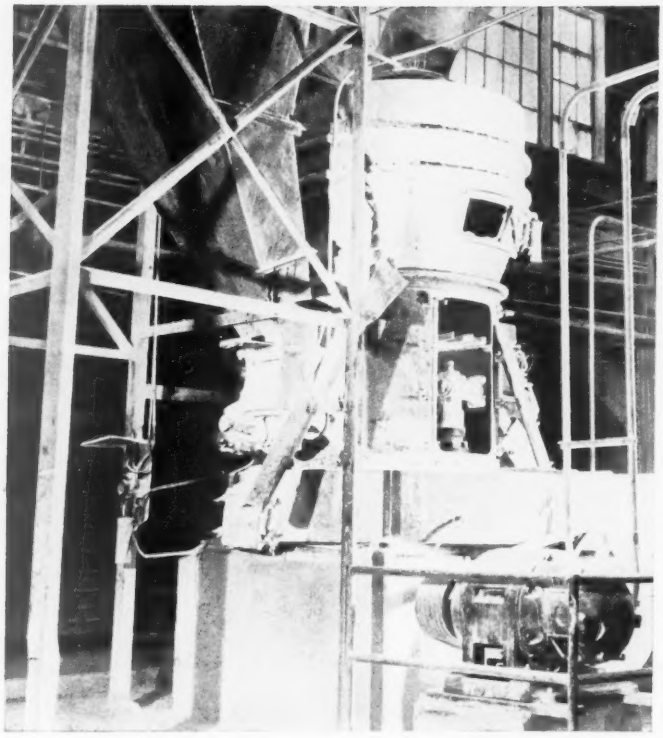

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CONTENTS FOR NOVEMBER, 1951

Plasticizers for GR-S Gasket Stocks to be Used at Low Temperatures—*By Ross E. Morris and Joseph W. Hollister* 195

Panel Discussion on Rubber-to-Metal Bonding 201

Hoisting Line for Latex Samples 210

Silicone Rubber—A Literature Review—*By John B. Gregory* 211

Photoelectric Interferometer for High Polymer Research .. 216

Dual Effectiveness of Polymeric Resin in Compounds 217

REGULAR DEPARTMENTS

Book Reviews	252	Los Angeles News	237
Canadian News	236	Names in the News	233
Chemical Prices	*	New Equipment	242
Classified Ads	272	New Goods	—
Coming Events	226	Obituaries	238
Editorials	218	Rubber, Cotton Markets	262
Financial News	235	Statistics	264

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RUBBER AGE

Vol. 70, No. 2 NOVEMBER, 1951

Plasticizers for GR-S Gasket Stocks to Be Used at Low Temperatures

By ROSS E. MORRIS and JOSEPH W. HOLLISTER

Rubber Laboratory, Mare Island Naval Shipyard, Vallejo, Calif.

GR-S does not crystallize appreciably *(1, 2, 3)*, but its hardness and stiffness increase and its resilience decreases as its temperature is lowered. These effects of low temperature can be mitigated by compounding the GR-S with plasticizers. The objective of this investigation was to select the best available plasticizers for this purpose. The investigation was a continuation of the work originally reported to representatives of the rubber and chemical industries at a conference held in the Bureau of Ships on November 3, 1948.

A great deal of practical and theoretical work has been done on polymer-plasticizer systems. Comprehensive articles on this subject have been written by Boyer *(4)*, Colborne *(5)*, and Stickney and Cheyney *(6)*. Juve and Marsh *(7)* compared 26 plasticizers in a GR-S stock from the standpoint of torsional stiffness at low temperatures. Three intrinsic properties of a plasticizer have been suggested as influencing its efficiency in reducing the internal viscosity of a polymer with which it is blended. These properties are molecular size, molecular weight, and viscosity. At the present time, a definite relationship between these properties of a plasticizer and its efficiency in reducing the internal viscosity of a polymer has not been established. The behavior at low temperatures of a polymer-plasticizer blend cannot be foretold from the properties of the plasticizer alone; it is necessary to actually test the blend.

This investigation was one phase of a more general investigation directed toward the development of a GR-S soft gasket stock for service at temperatures as low as —35°F. Published *(7)* and unpublished work by this laboratory has shown that the cold compression set *(2)* correlates with the sealing ability of a gasket at low temperatures. For that reason, the cold compression set test was selected as the screening test for evaluating the GR-S vulcanizates containing the various plasticizers under study.

The best plasticizers selected from the standpoint of reduction of cold compression set were further investigated to determine their permanence when the respective vulcanizates were exposed to hot air or immersed in water.

Preparation of Stocks

The plasticizers studied in this investigation numbered 181. They were all liquids at room temperature and comprised mostly esters, but also included ethers, alcohols, hydrocarbons, chlorinated hydrocarbons, nitriles, and proprietary mixtures derived from petroleum or coal tar. The formulation used for compounding the stocks containing the plasticizers is given below. This formulation containing Flexol TOF (tri-2-ethylhexyl phosphate) as the plasticizer has been used successfully for manufacturing soft gaskets for Navy applications.

TEST FORMULA

	Parts by Weight
GR-S	100
MAF black (Philblack A)	40
Zinc oxide	5
Blended wax (Heliozone)	1
Tetramethyl thiuram disulfide (Methyl Tuads)	1
Sulfur	1
Plasticizer	20.3*

* Volumes per 100 volumes GR-S.

Masterbatches were used for mixing the experimental stocks in order that variations other than the plasticizer would be avoided. The furnace black was contained in a latex-compounded masterbatch, GR-S X-419, manufactured by the General Tire and Rubber Company. A second masterbatch was prepared on a 16 x 40-inch mill from the GR-S X-419 and the other compounding ingredients listed above, excepting the plasticizer. The second masterbatch was divided into small portions and the respective plasticizers were added to these portions on a 6 x 13-inch mill. Every effort was made to keep conditions the same when mixing these batches. The elapsed time between mixing and curing was 16 to 32 hours, and between curing and testing was at least 7 days. The conditioning temperature for the uncured and cured stocks was 82°±5°F.

Cold Compression Set

Procedures: The cold compression set test was conducted on molded specimens in the form of right cylinders 1.129 inches in diameter and 0.50 inch thick (A.S.T.M. standard specimen) which had been cured for 20 minutes at 310°F. It was recognized that the various plasticizers probably affected the rate of cure of GR-S to different extents, so that all of the compression set specimens were not necessarily at the same state of cure after 20 minutes at 310°F. It was not feasible, however, to study the effect of each plasticizer on rate of cure in order to adjust the curing times of the respective stocks. Fortunately, cold compression set has been found to be little influenced by minor variations in state of cure.

Before starting the cold compression set test, the specimens were tested for instantaneous Shore A hardness and Bashore rebound *(8)*. These tests were not used to classify plasticizers, but were included for further information.

For the cold compression set test, the specimens were compressed 40% between smooth, chromium-finished steel plates, held at this deflection by means of bolts and spacer bars, and placed in a methanol bath maintained at —35°±2°F. within 5 minutes after compression. The methanol contained about 20% water by volume; it had practically no tendency to extract the plasticizers from the specimens or to swell the specimens *(2)*. After being compressed for 166 hours in the cold methanol, the specimens were released from the clamps while still in the methanol and permitted to recover for exactly 30 minutes. Their thicknesses were then determined with a dial micrometer. The compression sets were computed by means of the following equation:

$$C = \frac{t_o - t_i}{t_o - t_s} \times 100$$

where: C = compression set expressed as percentage of original deflection
t_o = original thickness of test specimen
t_i = thickness of test specimen 30 minutes after removal from clamp
t_s = thickness of spacer bars

Since GR-S itself does not crystallize appreciably, the compression set of a GR-S stock without plasticizer reaches virtual equilibrium after conditioning the compressed specimen for only a few hours. Notwithstanding this behavior, it was decided to establish the conditioning time of the compressed specimens at 166 hours (7 days), in order to effect any separation or crystallization of the plasticizer which might tend to occur in the vulcanizate. Such phase changes would, of course, increase the internal viscosity of the vulcanizate and thus increase its cold compression set.

Results: The results of the tests on all of the plasticizers are given in Table I. In this tabulation the plasticizers are separated into groups, each of which covers a range of 5% in compression set. No distinction is made between the individual plasticizers in a group. This seemed to be a more equitable way of presenting the results of the tests than listing the plasticizers in order of increasing set. The latter arrangement would place more emphasis on the individual set values than is warranted by the precision of the tests. For example, di-capryl sebacate with 30.2% set would stand 4th in the list, while tri-butyl citrate with 34.5% set would stand 29th in the list. From this arrangement the reader might gain the impression that di-capryl sebacate is a much better plasticizer for GR-S than tri-butyl citrate, whereas actually the standings of these plasticizers might be reversed if the tests were repeated a sufficient number of times, even though great care were taken to avoid errors and inconsistencies in the determinations.

The extent of variation in results of replicate determinations of compression set is exemplified by the results of the tests on the stock containing Flexol TOF. This stock was mixed, cured and tested 12 times during the course of the survey. The statistical data given below are based on the averaged results obtained from three specimens in each of the 12 tests.

Statistical Data for Stock containing Flexol TOF	
Maximum of averaged compression sets	36.5%
Mean of averaged compression sets	34.8%
Minimum of averaged compression sets	32.1%
Average deviation	1.0
Standard deviation	1.5

In view of the possible differences between replicate determinations illustrated above, it should be recognized that each of the plasticizers in Table I might be found to fall into a group immediately above or immediately below its present group if the respective stocks were remixed, recured and retested. For example, di-hexyl phthalate is shown in the 45-50% group, but if the stock containing this plasticizer were remixed, recured and retested, it might be found to fall in the 40-45% group or in the 50-55% group. It is doubtful that a plasticizer upon rechecking would be found to fall in a group twice removed from its present group.

The stock which contained no plasticizer had a Shore A hardness of 54, a Bashore rebound of 53%, and a set at —35°F. of 51.3%. Comparison of the latter value with the compression sets of the plasticized stocks showed that about half of the plasticizers actually increased the compression set of GR-S at —35°F. All of the plasticizers, of course, reduced Shore hardness at room temperature, some by as much as 19 points. All but three of the plasticizers reduced Bashore rebound. Fifteen of the plasticizers exuded from their respective vulcanizates. TP-95 was one of the plasticizers which exuded, but was one of the best plasticizers for improving set at —35°F. This plasticizer would probably be satisfactory if used in smaller quantities.

The fifteen adipates tested were found, with one exception, to be outstanding plasticizers. All of the stocks containing adipates, except the stock containing TP-98 (di-methoxyethoxyethyl adipate), had sets less than 40%. Five of the twelve sebacates tested also yielded stocks with sets less than 40%.

Volatility and Extractability by Water

The ability to improve cold compression set is not the only characteristic to be considered when selecting a plasticizer for GR-S gasket stocks intended for low temperature service. Two other important characteristics,

Table I—Results of Screening Tests

Trade Name of Plasticizer	Chemical Name (if different from Trade Name)	Source	Sp. Gr. at 82° F.	Properties of Vulcanizate: Shore A Hardness at 82° F.	Bashore Rebound at 82° F. (%)	Compression Set after 7 days at −35° F.
Plastoflex No. 3	di-butoxyethyl adipate	Advance Solvents	1.00	39	52	within range
Di-hexyl adipate		Binney & Smith	0.92	40	51	28 to 35%
Di-iso-octyl sebacate		Binney & Smith	0.92	39	51	"
Flexol 3GH	tri-glycol di-hexoate	Carbide & Carbon	0.99	41	51	"
Flexol 4GO	polyethylene glycol di-2-ethyl hexoate	Carbide & Carbon	0.98	40	50	"
Flexol TOF	tri-2-ethylhexyl phosphate	Carbide & Carbon	0.92	38	51	"
Special Flexol TOF	tri-2-ethylhexyl phosphate	Carbide & Carbon	0.92	38	51	"
Plasticizer 3425	butyl cellosolve pelargonate	C. P. Hall Co.	0.90	42	52	"
Plasticizer 3560	di-isobutyl azelate	C. P. Hall Co.	0.93	40	52	"
Di-2-ethylhexyl succinate		C. P. Hall Co.	0.93	39	50	"
Di-iso-octyl succinate		C. P. Hall Co.	0.93	39	51	"
Di-isobutyl adipate		DuPont	0.95	40	51	"
Di-benzyl ether		Eastman Kodak	1.05	41	53	"
Plastolein 9050	di-2-ethylbutyl azelate	Emery Industries	0.93	40	51	"
Plastolein 9058	di-2-ethylhexyl azelate	Emery Industries	0.92	37	50	"
Plasticizer 12	di-isobutyl adipate	Godfrey L. Cabot	0.95	40	52	"
Di-butyl phthalate		Griffin Chemical	1.04	40	52	"
Di-capryl sebacate		Hardesty Chemical	0.90	40	51	"
Di-hexyl sebacate		Hardesty Chemical	0.91	39	53	"
ISO X14	not disclosed	Industrial Solvents	1.01	43	52	"
ISO X22	not disclosed	Industrial Solvents	0.94	40	50	"
ISO X23	not disclosed	Industrial Solvents	0.95	40	52	"
Di-ethyl phthalate		Monsanto	1.12	43	53	"
Adipol BCA	di-butoxyethyl adipate	Ohio-Apex	0.99	40	51	"
Adipol 2EH	di-2-ethylhexyl adipate	Ohio-Apex	0.92	38	50	"
Dinopol	di-n-octyl phthalate	Ohio-Apex	0.97	38	50	"
Tri-butyl citrate		Pfizer Chemical	1.04	39	52	"
Tri-butyl aconitate		Pfizer Chemical	0.92	41	51	"
TP-90B	butyl carbitol formal	Thiokol Corp.	0.97	42	51	"
TP-95 *	di-butoxyethoxyethyl adipate	Thiokol Corp.	1.02	42	52	"
FX-103	di-n-butyl adipate	U. S. Industrial Chem.	0.96	42	50	"
FX-104	di-n-amyl adipate	U. S. Industrial Chem.	0.95	40	49	"
FX-105	di-n-hexyl adipate	U. S. Industrial Chem.	0.93	40	48	"
Plastoflex No. 20	not disclosed	Advance Solvents	1.02	40	49	within range
P-4	methyl acetyl ricinoleate	Baker Castor Oil	0.94	40	50	35 to 40%
P-6	butyl acetyl ricinoleate	Baker Castor Oil	0.93	37	49	"
Di-capryl adipate		Binney & Smith	0.92	40	49	"
Di-iso-octyl adipate		Binney & Smith	0.93	40	51	"
Di-nonyl adipate		Binney & Smith	0.93	40	51	"
Di-nonyl sebacate		Binney & Smith	0.90	40	51	"
Flexol 3GO	tri-glycol di-octoate	Carbide & Carbon	0.96	40	51	"
Flexol TWS	not disclosed	Carbide & Carbon	1.05	40	50	"
Ucon lubricant	polyalkylene glycol	Carbide & Carbon	0.95	38	48	"
Santicizer B16	butyl phthalyl butyl glycollate	Monsanto	1.10	40	51	"
Santicizer 141	not disclosed	Monsanto	1.09	38	51	"
Santicizer 160	butyl benzyl phthalate	Monsanto	1.13	40	50	"
Adipol 10A	di-iso-octyl adipate	Ohio-Apex	0.92	38	52	"
KP-120	methoxyethyl acetyl ricinoleate	Ohio-Apex	0.96	38	48	"
KP-140 *	tri-butoxyethyl phosphate	Ohio-Apex	1.01	37	49	"
Ohopex Q-10	fatty, phthalic acid esters	Ohio-Apex	0.95	40	50	"
Monoplex DOS	di-octyl sebacate	Resinous Products	0.91	39	49	"
Monoplex 16	not disclosed	Resinous Products	0.90	39	48	"
Dibutyl acetamide		Sharples Chemicals	0.88	44	51	"
Hexyl carbitol formal		Thiokol Corp.	0.95	40	50	"
FX-101	di-octyl ester of modified lactic acid	U. S. Industrial Chem.	1.00	40	49	"
FX-106	blend of di-n-butyl adipate with an organo-silane	U. S. Industrial Chem.	0.94	40	48	"
FX-107	blend of di-n-butyl adipate with another organo-silane	U. S. Industrial Chem.	0.93	40	48	"
Plastoflex No. 10	not disclosed	Advance Solvents	1.02	42	50	within range
Plastoflex No. 52	di-hexyl phthalate	Advance Solvents	0.99	38	51	40 to 45%
Plastoflex FP6	di-butyl tetra-chlorophthalate	Advance Solvents	1.29	38	50	"
Vistac No. 4	not disclosed	Advance Solvents	0.90	47	43	"
P-8	glyceryl tri-aceto ricinoleate	Baker Castor Oil	0.97	37	48	"
P-40	not disclosed	Baker Castor Oil	0.95	37	50	"
Plasticizer 50B	butyl cylohexyl phthalate	Barrett Division	1.07	38	52	"
Benzyl cellosolve *		Carbide & Carbon	1.07	42	52	"
Flexol 8N8	2, 2' (2-ethylhexamido) diethyl di (2-ethylhexoate)	Carbide & Carbon	0.96	39	49	"
Plasticizer 2489	not disclosed	C. P. Hall Co.	0.97	39	50	"
Alpha-chloro naphthalene		Eastman Kodak	1.25	43	51	"
Butyl cellosolve oleate		Glyco Products	0.89	38	50	"
Di-glycol di-naphthenate		Glyco Products	1.00	38	49	"
Di-octyl phthalate	di-2-ethylhexyl phthalate	Ohio-Apex	0.98	39	50	"
Kronisol	di-butoxyethyl phosphate	Ohio-Apex	1.06	40	51	"

TABLE I—RESULTS OF SCREENING TESTS (Continued)

Trade Name of Plasticizer	Chemical Name (If different from Trade Name)	Source	Sp. Gr. at 82° F.	Properties of Vulcanizate: Shore A Hardness at 82° F.	Bashore Rebound at 82° F. (%)	Compression Set after 7 days at −35° F.
Telura 35	hydrocarbon mixture	Penola Co.	0.87	38	51	within range
Acetyl tributyl citrate		Pfizer Chemical	1.05	40	50	40 to 45%
Di-capryl phthalate		Resmous Products	0.97	39	50	"
Monoplex 11	not disclosed	Resmous Products	1.00	39	49	"
Amyl benzoate		Sharples Chemicals	0.99	44	50	"
Amyl laurate		Sharples Chemicals	0.86	38	49	"
N,di-amyl acetamide		Sharples Chemicals	0.88	40	51	"
PD-706A	naphthenic oil	Socony-Vacuum	0.88	42	52	"
FX-102	di-octyl ester of modified adipic acid	U. S. Industrial Chem.	1.00	40	49	
Dispersing Oil 10	coal tar oil	Barrett Division	1.02	43	51	within range
Elastex 28P	di-2-ethyl phthalate	Barrett Division	0.98	37	51	45 to 50%
Di-hexyl phthalate		Binney & Smith	0.99	40	47	"
Undecanol		Carbide & Carbon	0.83	44	51	"
Tetradecanol		Carbide & Carbon	0.83	41	51	"
Beta-phenyl ethyl chloride		Eastman Kodak	1.07	47	51	"
Chloroethyl phenyl ether		Eastman Kodak	1.15	45	50	"
Di-chloro isopropyl ether		Eastman Kodak	1.11	48	51	"
Plastolein 9250	tetra-hydrofurfuryl oleate	Emery Industries	0.92	37	48	"
DIOP	di-iso-octyl phthalate	Ohio-Apex	0.98	40	50	"
Kapsol	methoxyethyl oleate	Penola Co.	0.90	35	50	"
Necton 37	hydrocarbon mixture	Sharples Chemicals	0.88	37	51	"
Amyl Oleate		Sharples Chemicals	0.87	38	49	"
Pentaryl A	Amyl diphenyl	Socony-Vacuum	0.97	40	50	"
Sovaloid L	naphthenic oil	Stanco Distributors	0.90	38	51	"
Bayol D	deodorized kerosene		0.78	45	51	"
Vistac No. 2	polybutene	Advance Solvents	0.90	42	44	within range
Arneel TO	mixed aliphatic and aromatic nitriles	Armour & Co.	0.91	36	49	50 to 55%
P-1	methyl ricinoleate	Baker Castor Oil	0.93	35	47	"
P-843	methyl cellosolve acetyl stearate	Baker Castor Oil	0.94	40	50	"
Bardol B	refined coal tar oil	Barrett Division	1.03	44	51	"
Hartflex 500	not disclosed	Binney & Smith	0.93	36	51	"
Heptadecanol		Carbide & Carbon	0.84	38	49	"
Di-chloroethyl ether		Eastman Kodak	1.21	48	50	"
o-Di-chlorobenzene		Eastman Kodak	1.30	48	50	"
p-Chloroanisole		Eastman Kodak	1.17	47	50	"
Chlorocyclohexane		Griffin Chemical	0.99	48	51	"
Tri-cresyl phosphate		Monsanto Chemical	1.16	40	50	"
Di-methyl phthalate		Monsanto Chemical	1.19	42	51	"
Santicizer 140*	cresyl diphenyl phosphate	Socony-Vacuum	1.20	40	46	"
Sovaloid A Special	compounded hydrocarbon oil	Socony-Vacuum	0.90	37	51	"
Sovaloid C	synthetic hydrocarbon oil	Socony-Vacuum	1.06	38	50	"
PD 706B	naphthenic oil	Sun Oil Co.	0.86	44	51	"
Circo light process oil	not disclosed		0.92	40	50	"
Vistac No. 1	liquid polybutene	Advance Solvents	0.90	40	44	within range
Bardol	refined coal tar fraction	Barrett Division	1.09	41	49	55 to 60%
Butoxyethyl diglycol carbonate*		Columbia Chemicals	1.02	42	49	"
Decalin	deca-hydro naphthalene	Eastman Kodak	0.88	48	49	"
Butyl cellosolve laurate		Glyco Products	0.89	42	51	"
Golden Bear light process oil	naphthenic hydrocarbons	Golden Bear Oil Co.	0.96	40	50	"
Piccocizer 30	polymerized aromatic distillate	Harwick Standard	1.01	44	50	"
Plasticizer ODX	octadecene nitrile	Harwick Standard	0.89	36	49	"
Santicizer E-15*	ethyl phthalyl ethyl glycollate	Monsanto Chemical	1.18	41	48	"
Santicizer M-17	methyl phthalyl ethyl glycollate	Monsanto Chemical	1.22	43	48	"
Dicarbitol phthalate*		Ohio-Apex	1.13	42	49	"
Acetyl triethyl citrate*		Pfizer Chemical	1.13	40	47	"
Sovaloid N	synthetic hydrocarbon oil	Socony-Vacuum	1.02	38	49	"
PD 355 D	kerosene and Duosol tar blend	Socony-Vacuum	1.02	38	48	"
TP-98*	di-methoxyethoxyethyl adipate	Thiokol Corp.	1.09	43	46	"
Arneel TOD	mixed aliphatic and aromatic nitriles	Armour & Co.	0.91	35	49	within range
P-1P*	benzyl ricinoleate	Baker Castor Oil	0.97	36	47	60 to 65%
B.R.V.	high-boiling coal-tar oil	Barrett Division	1.16	40	49	"
Capryl benzyl sebacate		Binney & Smith	0.98	38	51	"
Methyl carbitol acetate		Carbide & Carbon	1.04	46	49	"
Flexol 3CF	tri-2-chlorethyl phosphate	Carbide & Carbon	1.41	40	48	"
Tetralin	tetra-hydro naphthalene	Eastman Kodak	0.97	45	49	"
Califlux 510	unsaturated naphthenic hydrocarbons	Golden Bear Oil Co.	0.99	40	50	"
ISO X # 2	not disclosed	Industrial Solvents	0.97	38	49	"
Methox*	di-methoxyethyl phthalate	Ohio-Apex	1.12	43	48	"
Plastogen	sulfonic acid and paraffine oil	R. T. Vanderbilt Co.	0.84	41	51	"
Reogen	sulfonic acid and paraffine oil	R. T. Vanderbilt Co.	0.86	42	50	"
Sovaloid A	compounded hydrocarbon oil	Socony-Vacuum	0.95	37	50	"

TABLE I—RESULTS OF SCREENING TESTS (Continued)

Trade Name of Plasticizer	Chemical Name (if different from Trade Name)	Source	Sp. Gr. at 82° F.	Properties of Vulcanizate: Shore A Hardness at 82° F.	Bashore Rebound at 82° F. (%)	Compression Set after 7 days at −35° F.
Plastolein 9055	di-ethylene glycol di-pelargonate	Emery Industries	0.96	40	50	within range
Butyl benzyl sebacate		Hardesty Chemical	1.00	41	52	65 to 70%
Dipolymer oil	coumarone-indene polymer	Harwick Standard	1.03	38	48	"
Santicizer 8*	N-ethyl toluene sulfonamides	Monsanto Chemical	1.20	44	40	"
KP-147*	not disclosed	Ohio-Apex	0.96	38	45	"
Cumar P-10	coumarone-indene polymer	Barrett Division	1.08	40	47	within range
Dibutyl sebacate		Binney & Smith	0.93	40	52	70 to 75%
Para Flux	saturated polymerized hydrocarbon	C. P. Hall Co.	1.03	40	46	"
Cellosolve laurate		Glyco Products	0.89	41	51	"
Theop	glycolyl ricinoleate	Glyco Products	1.00	38	47	"
Dipentene		Hercules Powder	0.90	45	47	"
Di-butyl tartrate		Pfizer Chemical	1.09	45	46	"
Arneel Plasticizer	not disclosed	Armour & Co.	0.85	35	50	within range
Para Lube	saturated polymerized hydrocarbon	C. P. Hall Co.	1.16	35	45	75 to 80%
ISO X #10	not disclosed	Industrial Solvents	0.89	40	51	"
Plastolein 9715	not disclosed	Emery Industries	1.07	41	48	within range
Plasticizer 2557	not disclosed	General Electric	1.20	37	48	80 to 85%
Di-butoxy ethyl sebacate		Hardesty Chemical	0.96	40	50	"
ISO X #1	not disclosed	Industrial Solvents	0.93	43	51	"
Di-butyl sebacate		Resinous Products	0.93	40	51	"
Amyl stearate		Sharples Chemicals	0.87	40	49	"
p-tert-Amyl phenoxyethyl laurate		Sharples Chemicals	0.95	40	49	"
Cottonseed oil		Wesson Oil Co.	0.92	35	48	"
Butyl stearate		Binney & Smith	0.86	38	52	within range
Plasticizer 2175	butyl cellosolve ester of cocoanut-fatty acid	C. P. Hall Co.	0.89	38	49	85 to 90% "
Glyceryl mono-ricinoleate		Glyco Products	1.01	40	47	"
Mono-ethylene glycol di-laurate*		Glyco Products	0.99	41	48	"
Propylene glycol mono-laurate		Glyco Products	0.99	38	51	"
Plasticizer SC	tri-glycol di-octylate	Harwick Standard	0.96	40	51	"
Ethox*	di-ethoxyethyl phthalate	Ohio-Apex	1.12	42	49	"
Flexol CA6	not disclosed	Carbide & Carbon	0.97	38	51	within range
Decyl levulinate		Glyco Products	0.92	40	49	90 to 95%
Glaurin G26	di-ethylene glycol mono-laurate	Glyco Products	0.95	37	47	"
Di-methyl sebacate		Hardesty Chemical	0.99	40	52	"
Di-n-octyl succinate		C. P. Hall Co.	0.92	40	51	within range
KP-23	butoxyethyl stearate	Ohio-Apex	0.88	38	51	95 to 100%
Di-benzyl sebacate		Resinous Products	1.06	41	51	"
FX-100	di-octyl ester of modified di-propionic acid	U. S. Industrial Chem.	0.96	40	47	"

* Exudes from GR-S vulcanizate at 82° F. when 20.3 volumes are present.

at least from the standpoint of the Navy, are volatility and extractability by water, since the loss of plasticizer from a stock by volatilization or extraction will eventually lead to poorer behavior at low temperatures. The GR-S stocks containing plasticizers found to be outstanding for low cold compression set were tested for volatility and water extractability.

Determination of Volatility: Volatility was determined by measuring the change in weight of thin specimens after exposure edgewise for 94 hours to a stream of fresh air heated to 158°±2°F. The velocity of the air stream was about 350 feet per minute. The specimens were 1 x 2 x 0.05 inch in size and were dried to constant weight in a desiccator at room temperature before exposure. The determinations were made in quadruplicate. After exposure the specimens were weighed and the volatility calculated from the following equation:

$$\text{Percent heat loss} = \frac{W_1 - W_2}{W_1} \times 100$$

where: W_1 = weight of dried specimen before exposure

W_2 = weight of specimen after exposure

Determination of Extractability: The loss of plasticizer from the stocks by water extraction was determined after immersing specimens of each stock in distilled water at 82°F. for 96 hours. The essential features of this test were, first, the determination of the percent loss in weight of specimens after extraction by water and drying to constant weight in a desiccator at room temperature, and second, the determination of the percent by weight of water initially in the vulcanizate by drying duplicate specimens which had not been immersed in water. The percent loss in weight by extraction was equal to the result of the first determination minus the result of the second determination:

$$\text{Percent water extraction} = \left(\frac{W_1 - W_2}{W_1} - \frac{W_3 - W_4}{W_3} \right) \times 100$$

TABLE II—RESULTS OF TESTS FOR VOLATILITY AND EXTRACTABILITY

Trade Name of Plasticizer	Chemical Name (if different from Trade Name)	Heat Loss (%)	Water Extract. (%)
None (control stock)		0.5	0.0
Tri-butyl aconitate		2.6	0.1
Plasticizer No. 12		11.2	0.3
FX-103	di-iso-butyl adipate	12.8	0.3
FX-104	di-n-butyl adipate	10.3	0.2
Di-hexyl adipate	di-n-amyl adipate	12.7	0.0
FX-105		3.9	0.1
Adipol 2EH	di-n-hexyl adipate	1.6	0.0
Di-iso-octyl adipate	di-2-ethylhexyl adipate	3.4	0.0
Adipol 10A		2.1	0.2
TP-95	di-iso-octyl adipate	1.7	1.8
Adipol BCA	di-butoxyethoxyethyl adipate	1.9	0.4
Plastoflex No. 3	di-butoxyethyl adipate	1.7	0.4
Plasticizer 3560	di-butoxyethyl adipate	9.7	0.5
Plastolein 9050	di-iso-butyl azelate	1.9	0.0
Plastolein 9058	di-2-ethylbutyl azelate	1.0	0.2
Tri-butyl citrate	di-2-ethylhexyl azelate	2.8	0.0
Di-benzyl ether		8.4	0.2
TP-90B	butyl carbitol formal	6.9	5.1
Flexol 3GH	tri-glycol di-hexoate	4.0	0.6
Flexol 4GO	polyethylene glycol di-2-ethyl hexoate	2.4	0.6
Plasticizer 3425	butyl cellosolve pelargonate	6.8	0.0
Flexol TOF	tri-2-ethylhexyl phosphate	1.4	0.8
Special Flexol TOF	tri-2-ethylhexyl phosphate	3.6	0.4
Di-ethyl phthalate		8.7	1.9
Di-butyl phthalate		9.4	0.1
Dinopol	di-n-octyl phthalate	1.0	0.1
Di-hexyl sebacate		1.5	0.1
Di-capryl sebacate		0.5	0.0
Di-iso-octyl sebacate		1.2	0.5
Monoplex DOS	di-octyl sebacate	1.3	0.2
Di-2-ethylhexyl succinate		3.2	0.1
Di-iso-octyl succinate		2.9	0.1
ISO X14	not disclosed	5.5	1.0
ISO X22	not disclosed	7.5	0.1
ISO X23	not disclosed	11.6	0.3

where: W_1 = weight of specimen before extraction
W_2 = weight of specimen after extraction and drying
W_3 = weight of control specimen before drying
W_4 = weight of control specimen after drying

Instead of using duplicate specimens for determining the initial water content of the vulcanizate, the specimens to be immersed could have been dried to constant weight beforehand. The objection to this procedure was the additional time required. The drying of the specimens could not be hastened by using elevated temperatures because plasticizer might also be lost.

Results of Tests: The results of the tests for volatility and extractability are given in Table II. The heat loss of the control stock (without plasticizer) was 0.5%. The heat losses of the other stocks exceeded this value, showing that all of the plasticizers were volatilized to some extent. If all of its plasticizer were lost, a stock would decrease in weight about 12.5%. Five stocks suffered decreases in weight which approached this value,

TABLE III—OUTSTANDING PLASTICIZERS FOR LOW COMPRESSION SET AT —35°F., LOW VOLATILITY AND LOW EXTRACTABILITY

Trade Name	Chemical Name (If different from Trade Name)	Curing time at 310°F.* (min.)	Tensile Strength (p.s.i.)	Ultimate Elongation (%)	Modulus at 300% Elong. (p.s.i.)
Adipol 2 EH	di-2-ethylhexyl adipate	27.5	1120	430	750
Adipol BCA	di-butoxyethyl adipate	27.5	1100	390	770
Plastolein 9050	di-2-ethylbutyl azelate	27	1130	390	790
Plastolein 9058	di-2-ethylhexyl azelate	33	1130	410	710
Flexol TOF	tri-2-ethylhexyl phosphate	19	1310	460	760
Dinopol	di-n-octyl phthalate	26	1040	370	800
Di-hexyl sebacate		28	1180	400	770
Di-capryl sebacate		28	1160	420	760
Di-iso-octyl sebacate		30	1170	420	730
Monoplex DOS	di-octyl sebacate	31	1220	420	790

* Curing times to attain 30% hot compression set when conditioned at 40% deflection for 46 hours at 194° F. according to A.S.T.M. Method of Test D395-49T, Method B.

being in excess of 10%. Of these stocks, four were plasticized with adipates of low molecular weight and one was plasticized with ISO X23, which was not identified as to chemical composition by its supplier. About one third of the 35 stocks tested had heat losses less than 2%, which is considered to be a reasonable value.

The stock without plasticizer lost no material by water extraction and the majority of the stocks containing plasticizer lost less than 1%. The plasticizer which was extracted to the greatest extent was TP-90B. The stock containing this plasticizer lost 5.1% by weight, or about 40% of the plasticizer.

There are some instances in Table II where two plasticizers apparently have the same chemical composition but have quite different values for volatility and extractability. Such discrepancies are believed to be due to differences in purity of supposedly identical plasticizers. For example, Flexol TOF and Special Flexol TOF were both identified by the manufacturer as being tri-2-ethylhexyl phosphate, but Special Flexol TOF was stated to be not as highly purified as Flexol TOF.

The plasticizers listed in Table III were selected on the bases of compression set at —35°F., volatility, and extractability as being particularly outstanding for compounding GR-S stocks for service at —35°F.

Included in this table are the times of cure and tensile properties of the stocks containing the respective plasticizers. The times of cure were those required to bring the stocks to the same state of cure as determined by the hot compression set test. The stock containing Flexol TOF was found to cure faster, 19 minutes, and to have somewhat higher tensile strength and ultimate elongation than the other stocks. The stock without plasticizer also cured in 19 minutes and had a tensile strength of 1600 psi, ultimate elongation of 340% and modulus of 1360 psi at 300% elongation.

Effect of Temperature and Recovery Time

It is stressed that the foregoing selection of plasticizers was based primarily on their relative abilities to reduce the compression set of a GR-S vulcanizate at —35°F. The relative abilities of the plasticizers to perform this function may be different at other temperatures. To examine this possibility and also to investigate the effect of recovery period, the stock without plasticizer and five stocks with plasticizer were tested for compression set at —60°, —30°, 0° and +30°F. after recovery periods of 10, 100, 1000, 1,800, 10,000 and 100,000 seconds at each temperature. The specimens were held at 40% compression for 22 hours before release instead of 166 hours as previously. Duplicate specimens of each stock were tested at each temperature and the results were averaged.

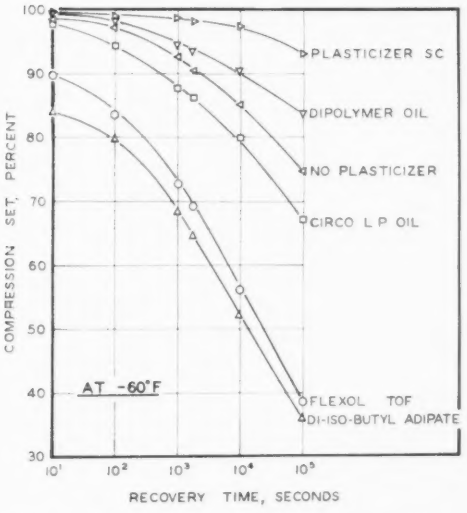

FIG. 1—Recovery of GR-S vulcanizates at —60° F.

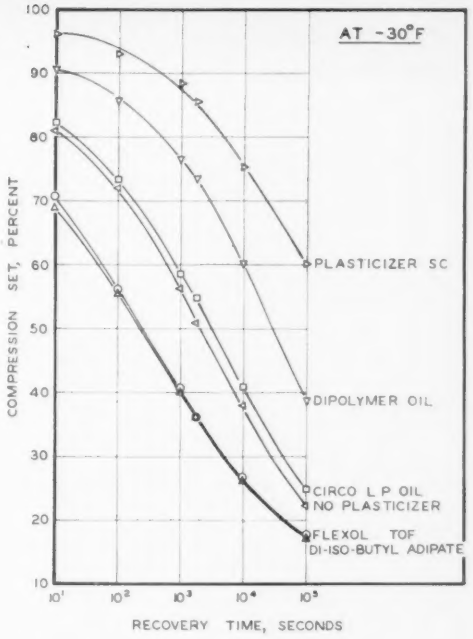

FIG. 2—Recovery of GR-S vulcanizates at —30°F.

The results of these tests appear in Figures 1, 2, 3, and 4. Each figure contains a plot of the compression sets of the six stocks versus log of recovery time at one temperature. The intervals of recovery were so widely spaced that it was impossible to plot all of the data for any specimen on one graph unless the log of recovery time were used.

Even at —60°F. all of the compressed specimens recovered to some extent during the period of 100,000 seconds (about 28 hours). The relative rates of recovery of the compressed specimens were different at the various temperatures. At —60°F. the specimens containing di-iso-butyl adipate and Flexol TOF recovered much faster than the specimens without plasticizer; but the higher the temperature, the less was the beneficial effect of these plasticizers. At —60°F. the specimens containing Circo LP oil recovered faster than the specimens without plasticizer, but at —30°F. and at higher temperatures the reverse was true. The specimens containing Plasticizer SC recovered much slower than the specimens without plasticizer at —60° and —30°F., but recovered faster at 0° and +30°F.

A possible explanation for the great effect of temperature on the plasticizing action of Plasticizer SC is that

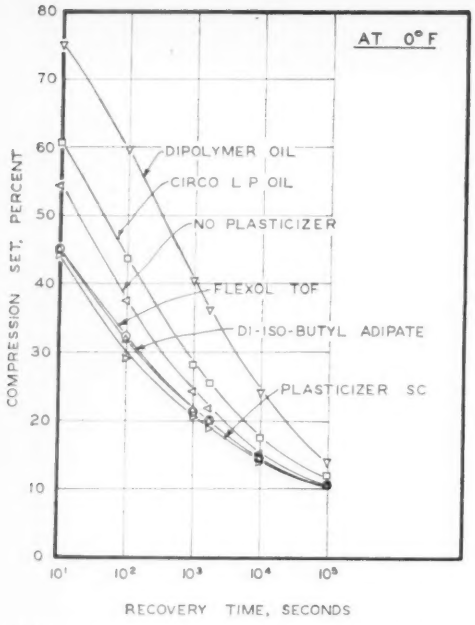

FIG. 3—Recovery of GR-S vulcanizates at 0°F.

the solubility of this material is less than 20.3 volumes per 100 volumes GR-S at —30° and —60°F. Consequently, the excess Plasticizer SC separated from the GR-S phase at these temperatures, probably in the form of micro crystals, and increased the internal viscosity of the rubber mass. The freezing point of Plasticizer SC was determined and found to be —5°F.

The high freezing point of Plasticizer SC is itself not an explanation for the anomalous behavior of the specimens containing this plasticizer, since di-iso-butyl adipate, which is an excellent plasticizer for GR-S at temperatures as low as —60°F., was found to have a freezing point of —13°F.

Most of the curves of compression set versus log of recovery time were concave toward the axes of the graphs at —60° and —30°F. and convex toward the axes at 0° and +30°F. Some of the curves, however, were shaped somewhat like a reversed S. This was the case for the curves of the specimens containing Circo LP oil, Flexol TOF, di-iso-butyl adipate, and no plasticizer at —30°F., and the curve for the specimens containing Dipolymer oil at 0°F. It is concluded from these examples that all of the curves at each temperature would have the shape of a reversed S if the recoveries had been measured over a wider range of time intervals, including shorter time intervals than 10 seconds for the higher temperatures and longer time intervals than 100,000 seconds for the lower temperatures.

Comparison with Theory: It is interesting to compare one of these curves with the corresponding curve showing recovery from compression of a simplified theoretical model of rubber. The theoretical model, illustrated in Figure 5, consists of an elastic element (spring) positioned parallel to a viscous element (dashpot). When this mechanical arrangement is compressed and then released, the recovery force, f_s, exerted by the spring at any instant, t, is resisted by the viscous force, f_v, due to the dashpot. These forces are virtually equal at all times during the recovery.

$$f_s = f_v$$

However, $f_v = n \frac{ds}{dt}$

where n = viscosity coefficient
s = distancy of recovery

and $f_s = -ks$ vectorially

where k = spring constant

Thus, $$-ks = n \frac{ds}{dt}$$

$$k\,dt = -n \frac{ds}{s}$$

Integrating, $$k \int_0^t dt = -n \int_{s_0}^{s} \frac{ds}{s}$$

$$kt = -n \log_e \frac{s}{s_0}$$

where s_0 = distance of total recovery

Since $$\frac{s}{s_0} = \frac{C}{100}$$

where C = compression set in percent

then $$kt = n \log_e \frac{100}{C}$$

or $$k_1 t = \log_{10} \frac{100}{C}$$

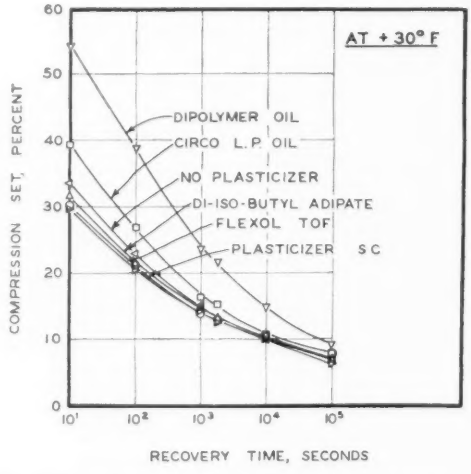

FIG. 4—Recovery of GR-S vulcanizates at +30°F.

This equation shows the relation between cold compression set and recovery time. When values of compression set are calculated from this equation for various values of time, assuming $k_1 = 0.000151$, the curve shown in Figure 6 is obtained. The curve for the stock without plasticizer at —30°F. is plotted on the same graph. Both curves have the same general shape, i.e., they resemble a reversed S. They intersect at 50% set because the value for k_1 in the theoretical equation had been so selected. The rate of recovery of the theoretical model is slower at the beginning and faster at the end than the rate of recovery of the actual specimen.

The curves in Figure 6 would not be expected to agree in anything except general shape because the theoretical curve is based on only one set of elements, whereas the actual curve is based on a GR-S specimen which can be considered to contain an almost infinite number of sets of such elements, each set varying in stiffness of the spring or viscosity of the oil in the dashpot *(10)*.

Summary

The best plasticizers for reducing the cold compression set of GR-S at —35°F. have been selected from a total of 181 plasticizers. The best plasticizers were further tested in a GR-S stock for extractability by water and volatility. Several GR-S stocks containing different plasticizers and a similar stock containing no plasticizer were checked for compression set at —60°, —30°, 0° and +30°F. after various recovery times. It was found that all of the stocks tended to recover from compression even at —60°F., and that the relative benefit of the plasticizers was not the same at the different temperatures.

ACKNOWLEDGMENT

Most of the testing in this investigation was done by Frank L. Shew, to whom the authors wish to express their gratitude. Dr. Jacob Oser determined the freezing point of the esters and assisted in developing the tests for volatility and extractability by water. Thanks are also due to others who assisted in one way or the other in this investigation.

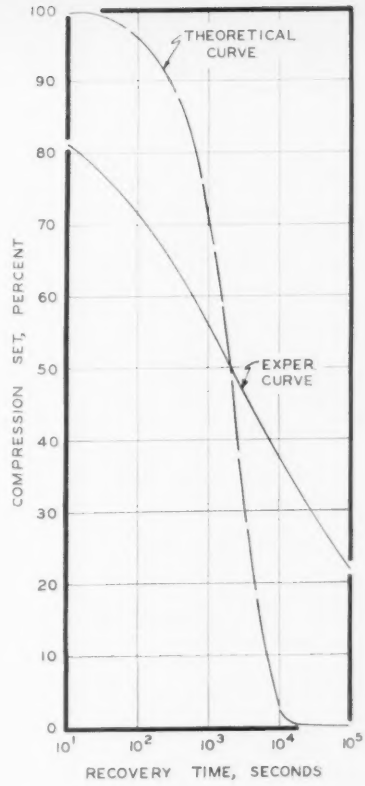

FIG. 6—Comparison of recoveries at —30° F. of theoretical model and GR-S vulcanizate without plasticizer.

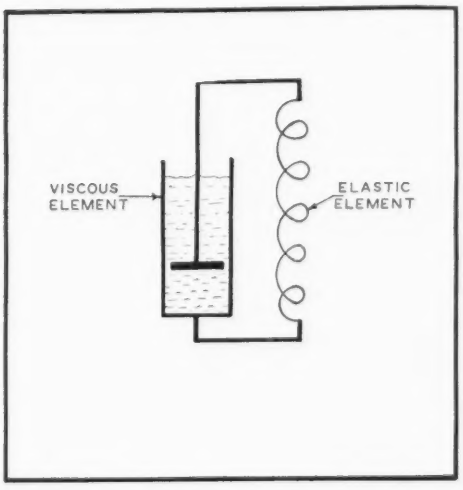

FIG. 5—Simplified theoretical model of rubber.

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Panel Discussion on Rubber-to-Metal Bonding

As Presented Before the Los Angeles Rubber Group at Its Meeting in Los Angeles on April 10, 1951

A PANEL discussion on Rubber-to-Metal Bonding featured the technical meeting of the Los Angeles Rubber Group held on April 10, 1951, at the Mayfair Hotel in Los Angeles, Calif. Joseph B. Larkin, chief chemist of the Patterson-Ballagh Division of the Byron Jackson Co., acted as moderator and chairman of the meeting. Those participating in the panel were: Fred Shor (MacClatchie), John Akers (Goodyear), F. J. French (Kirkhill Rubber) and Bert Reynolds (Stoner Rubber). The subject was divided into four broad classifications, discussed as follows: "Metal Preparation" by Mr. Shor; "Compounding" by Mr. Akers; "Cements" by Mr. Reynolds; and "Molding and Testing" by Mr. French. The four papers which were presented at the meeting and the questions and answers which followed are presented herewith.

Metal Preparation

By FRED SHOR

MacClatchie Manufacturing Co., Compton 2, Calif.

THE brass plating of metallic inserts is one of the most important methods of bonding rubber to metal. It consists of depositing a thin layer, often only .00001 of an inch thick, of a copper-zinc alloy on the surface of the metal being treated. Even when all precautions are taken, bond failures do occur occasionally but this is equally true for other methods of bonding rubber to metal.

The types of metal that an elastomer can be bonded to by means of brass plating are cast and malleable iron, low and high carbon steel (although low carbon steel is far superior), zinc, copper, aluminum and their alloys, cadmium, nickel, stainless steel and others. It should be emphasized that metal parts which are to be brass plated for bonding must be non-porous, otherwise cleaning and plating solutions are retained in the pores of the metal and bleed out during vulcanization, resulting in spotty adhesion areas.

The metal parts to be bonded are degreased, pickled or shot-blasted, and then suspended from the cathode bar in a brass plating solution. Brass is deposited as an alloy from anodes of the same material. The plated metal acts as the cathode in a conducting solution which consists of a mixture of copper and zinc cyanides along with other chemicals to give high conductivity and greater stability. Solution composition, temperature, amperage, voltage, current density, pH, time of plating and agitation are all carefully controlled. After plating the parts are washed in water, dried and cemented before vulcanization.

The principal advantages of brass plating are: (1) The formation of age resisting bond; (2) The formation of heat resisting bond; (3) The formation of oil and solvent resisting bond; (4) A surface treatment that will not wipe off under the flow of the rubber compound during vulcanization.

The theory of adhesion of rubber to a brass plate is one of a chemical linkage between the reactants: copper, zinc, sulfur and rubber. Brass is discolored when a satisfactory rubber adhesion is observed, which indicates that a chemical reaction has taken place between the rubber and brass plating. The fundamental factors governing a bond are: (1) Activity of the rubber; (2) Activity of the brass; (3) Vulcanization process.

In general, softeners and antioxidants do not appear to materially affect bond. Reinforcing fillers rapidly raise the adhesion strength to as much as 1,000 lbs. per square inch from a pure gum compound which has an adhesion strength of 200 lbs. per square inch. Sulfur is apparently necessary for a bond, rising slightly from ½%, but no improvement in bond strength is obtained by increasing it from 5 to 10 percent.

The ingredient which seems to have the most pronounced effect on bond is the accelerator. A slow rate of set up is essential for satisfactory bonding. An increase in vulcanization activity is accompanied by a decrease in activity of the bonding reaction.

The second fundamental which considers the type of brass is most important. The factors which must be considered are the composition of the brass, crystal structure and presence of co-deposited substances with the brass plate. Brass usually specified for adhesion contains 70% copper and 30% zinc, but rubber can be bonded to brasses ranging from 60-80% copper. Generally speaking, the adhesion falls as the percent of copper rises. Crystal structure is apparent when a new bath is being started, but with established baths in regular work variations are less pronounced. Co-deposition of foreign substances with the brass often interferes with the rubber-to-brass bond.

The third factor—vulcanization process—takes into account molding conditions such as pressure, rubber movement, amount of heating and rate of heating. Pressure and rubber movement is largely a mechanical one of placing rubber in the right place at the right time. The amount and rate of heating are more important from a chemical standpoint, slow heating favoring the attack of the brass by sulfur. Undercure and overcure seem to affect adhesion only slightly. The main drawback against the use of brass plate, in spite of excellent adhesion results, is the uncertainty about what constitutes quality in a plated metal and how to control the plating process so as to obtain the necessary quality at all times.

Compounding

By JOHN AKERS

Goodyear Tire and Rubber Co., Los Angeles 1, Calif.

IN compounding for metal adhesion we are concerned not only with obtaining a bond between some type of metal surface, but with the end-use for which the part is intended. Questions such as, "How strong a bond will actually be needed to resist the forces of tensile and shear which may act upon the rubber?" and "What will be the effect of heat, solvents and chemicals upon the union of rubber and metal?" must be answered before the compounder can begin to design a stock for any given application.

Elastomers are bonded to many types of metal and the following applications will be briefly discussed: (A) Tank and Pipe Lining; (B) Industrial Roll Covering; (C) Solid Tire Treads; (D) Miscellaneous Molded Goods.

(A) Tank and Pipe Lining: The main function of tank and pipe lining compounds is to resist the attack of solutions and chemicals. Very rarely is any type of metal, other than iron or steel, used for either tanks or piping, and only three different elastomers are customarily employed. Because neoprene plays only a minor part in these particular applications, the following discussion will be limited to natural rubber and GR-S.

Natural rubber is compounded in both soft and semi-hard stocks. Soft rubber linings (30 to 60 Shore) are usually loaded with furnace blacks and are cured at normal sulfur and acceleration levels. The addition of resinous or tacky softener is a distinct aid to good building adhesion. Semi-hard rubber stocks are used for the more severe types of service and are usually loaded with some inert filler such as silica or barytes. High sulfur and normal acceleration are combined with tacky softeners.

When semi-hard rubber or GR-S linings are used it is advantageous to use a softer rubber tie gum. As the actual metal adhesion is effected through the tie gum, some compound information on this type of stock is essential. Tie gums are usually loaded with furnace blacks and tacky softeners, and contain normal acceleration. Low sulfur (insoluble sulfur may well be employed) is advisable, due to the migration of this material from the semi-hard cover stock.

GR-S is only used as a semi-hard stock, and usually in conjunction with a softer, natural rubber tie gum. Glue precipitated, low water absorption GR-S is preferable for this application. The same general compounding rules apply here as did to rubber, but the percentage of tacky softeners is usually increased.

(B) Industrial Roll Covering: Gum-covered industrial rolls require an excellent bond because the shearing forces are so great. As was true of tank lining, steel is the commonly used metal. Natural rubber, neoprene, GR-S and Buna N have all been used as roll covering stocks, but at the present time neoprene usage surpasses that of all the others.

Neoprene compounds may be white or black and hard or soft. The softer compounds require a certain amount of Neophax and process oil. The rate of cure is decelerated by reducing the parts of zinc oxide, and the loading pigments may be furnace black, clay or barytes.

As the Shore hardness is increased, both the Neophax and process oil are reduced until the former is eliminated completely. Furnace blacks may be replaced by channel blacks and white fillers by Silene EF.

(C) Solid Tire Treads: Solid tire stocks also require a good metal bond. In this application two metals are in common usage, i.e., aluminum alloys for small, molded-on wheels, and steel for the larger and more severe applications.

As this type of commodity is now generally limited to GR-S, the following discussion will apply to that polymer only. Although the stock can be bonded directly to aluminum alloys, a safer method is to use a natural rubber tie gum with a lower Shore hardness.

GR-S tread stocks can be made from either regular or cold rubber polymers, but the latter will give the better service. In lower grade stocks some reclaim or tread peel springs may be used and the black loading can be split between channel and furnace types. For severe applications, channel black appears to be superior to all others. Strip adhesion can often be doubled by cementing or solvent washing the slugs before molding. (This is especially true when the stock is applied directly to the cemented metal).

Natural rubber tie gums should be 60 ± 5 hard and should contain a loading of both carbon black and zinc oxide. The softener content should be kept low, and the accelerator and sulfur ratios should be normal. (Insoluble sulfur can well be utilized in all tie gum stocks as well as tie cements).

(D) Miscellaneous Molded Goods: This last and most interesting division of compounding for metal adhesion includes all the miscellaneous items such as automotive parts, airmotive parts, valves, oil well specialties and many others. In this section we encounter nearly every type of metal, and because the parts are small and conveniently handled, brass plating plays a major role. As the products vary so greatly in usage and in physical properties, only general rules can be given, as follows:

Natural Rubber Compounds

(a) When the compound is 70 or over in hardness, it is better to use a softer tie gum.
(b) Cementing or solvent washing the slugs will improve adhesion.
(c) Keep prepared slugs covered and free from dusting materials, dirt or grease.
(d) Loadings of channel black and zinc oxide give the best adhesion to Ty-Ply, while reinforcing furnace blacks give better adhesion to brass plate.
(e) Sulfurless compounds do not as a rule give good adhesion, especially to brass plate.
(f) Avoid the use of non-tacky or bloom-producing softeners such as paraffine and petrolatum.
(g) Avoid excessive acceleration and accelerator bloom. The same is true for antioxidants.
(h) Avoid or wash off dusting powders such as talc and whiting. (Zinc stearate may be used.)

GR-S Compounds

(a) While GR-S can be bonded directly to a prepared metal surface, it is safer to use a natural rubber tie gum. (Especially true when over 70 hard stocks are in use.)
(b) Follow the same general rules for cleanliness and washing slugs.
(c) The same principles apply to sulfurless compounds and to acceleration, although the type of acceleration is not so critical when bonding to brass plate.

(d) Channel black appears to be the best loading material for GR-S.
(e) Use limited amounts of paraffine and antioxidants.

Neoprene Compounds

(a) SRF black is the best loading material for neoprene although MPC, clay and Silene EF may be used.
(b) Use resinous or ester type softeners.
(c) Avoid the use of aliphatic solvents when cleaning stock.
(d) Apply the same general rules for cleanliness and care of material.
(e) If neoprene is applied to Ty-Ply cemented steel, corrosion may take place under the bond. Either use brass plate or use Parlon.

Buna N Compounds

Buna N may be bonded to steel or aluminum alloys with equal ease. Loxite or a baked phenolic resin makes the best bonding material for aluminum. Ty-Ply BN may also be used.
(a) P-33, SRF and HMF blacks are good loading materials.
(b) Use only a small amount of stearic acid and no petroleum type softeners.
(c) Zinc oxide from 5 to 10 parts is essential.
(d) Sulfur should be kept from 1.5 to 3.0 parts, and the accelerators in common usage are Altax, Tuads, litharge and Vandex.
(e) Always clean slugs before molding, using a ketonic-type solvent, or use freshly tubed stock.
(f) Avoid all types of dusting materials and mold lubricants.

Butyl Compounds

There is no known method of producing good adhesion between Butyl and any type of metal, but a serviceable bond may be secured between acid pickled brass and this polymer.
(a) SRF black is the best type of loading material.
(b) Use from 5 to 15 parts of zinc oxide.
(c) Relatively high sulfur, 2 to 4 parts, aids adhesion.
(d) Captax-Tuads acceleration is satisfactory.

I realize that these general statements will not solve any specific compounding problem, but they may aid in avoiding unnecessary pitfalls. Each particular problem can only be worked out by diligently following a laboratory test program.

Cements

By BERT REYNOLDS
Stoner Rubber Co., Anaheim, Calif.

I THINK the subject has been very well discussed on bonding 55 Shore and making a compound that will bond. We have been concerned with making any compound bond, and that involves many cements. In fact we have developed about 60 cements to match our various stocks. Stocks which have been approved for specifications are bonded to various metals and tested to meet those conditions one couldn't meet before, using a conventional black compound and having only bonding in mind.

We believe that the logical approach for the rubber chemists is to match the cement with the stock. Not all commercial cements are available, so we have developed our own cements and are having a great deal of success with them. We can bond natural rubber of 15 to 95 Shore, and that applies to most of the other polymers too. We have developed cements that solvent won't remove and in some instances we had to burn both the rubber and metal to break the bond. To salvage the inserts remove the char. On other occasions we attempt to break the bond by tumbling the covered inserts at a temperature of —108°F. Here again, the cement plays an important part. We feel that it is more important to develop bonding cements than it is to match the compound to the cement.

We believe there is a great need for bonded parts in the aircraft industry and we have had to do a lot of selling in order to do that. These aircraft engineers have been told that low durometer stock cannot be bonded satisfactorily. We encountered this in the beginning with vibration isolators where the holes are drilled in the super-structures. The engineers felt it involved many changes to produce vibration isolators and said we would have to make softer compound in the hardness range of 15 and 20 Shore. This required considerable development but an answer has been found. It was in cements. I don't care to discuss any further how we make the cements; however, it has been a solution to many of our problems.

There are one or two questions on bonding on 90 Shore Hycar. We suggest a phenolic type cement which can be found in the Hycar Blue Book. The process involves one coat, heating it, applying another coat and carefully restricting the flow.

Molding and Testing

By F. J. FRENCH
Kirkhill Rubber Co., Brea, Calif.

YEARS ago the bonding of natural rubber to a few of the common metals such as aluminum, brass and steel did not present too difficult a problem to the rubber engineer. The introduction of neoprene to the rubber industry did increase bonding problems until today, the bonding of all types of synthetics to the various metals and alloys has become a science in itself.

Improper mold design or insert design will weaken a bonded part. A flash mold is so-called because any excessive material allowed to escape between the land area of the mold is called "flash" or "overflow." If inserts are used in this mold, the bond must be carefully checked because the wiping action of the stock may, as it flows out of the mold, remove the bonding cement. It is also

important that the insert is so positioned that it does not lie on the same plane with the parting line of the mold.

The compression type mold consists of a cavity and plunger with suitable registering pins to hold the various pieces of the mold together. Molds of this type are very suitable for holding inserts in place. In designing a compression mold, the removal of the bonded part without causing an undue strain on the bonded area should always be kept in mind.

Today the transfer mold is as popular as the flash and compression type molds. As the charge is introduced into this mold it is a soft, spaghetti-shaped mass that flows around the insert without distorting it or wiping away any excess amount of bonding cement. For this reason it is used by many rubber shops in special applications.

Designing the Bonding Insert

In designing an insert to which rubber is to be bonded one should use as large a safety factor as possible. By this we mean inserts should not be easily distorted and the bonding area should be great enough to allow the rubber to hold without rupture when the part is in actual commercial use.

A high or low curing temperature does not necessarily result in a good or bad bond. A good bond results when the sulfur reacts with the bonding cement and rubber simultaneously so that the rate of cure is not too fast to cause the rubber to set-up nor too slow so that the bond sets up while the rubber is still in a plastic condition. Gurney, an English rubber engineer, stated that the bond strength could be correlated to the time required for a stock to set-up. The values he obtained when rubber was cured to a brass plate are as follows:

Adhesion—lbs. per sq. in.	1,000 lbs.	900 lbs.
Set-up Time	8 mins.	12 mins.
Adhesion—lbs. per sq. in.	700 lbs.	600 lbs.
Set-up Time	13 mins.	83 mins.

Buchan in his book entitled "Rubber to Metal Bonding" states that a bond starts when cuprous sulfide is formed which in turn reacts with the rubber molecule at points of unsaturation. As mentioned earlier, cure is not critical in obtaining an ultimate bond unless the rubber is over or under-cured to such an extent that the tensile and tear resistance of it is impaired.

Although most bonds are thermosetting in nature, any rough handling will cause the bond to break. Parts bonded with cements, when hot, have a bond strength less than one-half of their bond strength when cold. In the case of phenol-formaldehyde cements, the bond strength when tested hot will be only 40 to 60% as great as the bond when cold.

Commercial versus Special Cements

A few rubber shops handle nothing but rubber bonded parts and consequently cannot depend entirely upon commercial bonding cements to take care of their problems. They are compelled to formulate many of their own bonding cements. However, in the majority of shops, standard bonding cements are used, and if these fail to produce the desired results, the rubber formulations or cements are altered until an acceptable bond is finally obtained.

Many synthetic rubbers are "boardy" when they are cold and it is most difficult to work with them when covering large areas of metal. The pre-heating of the stock under infra-red lamps or on controlled steam tables will result in a stock soft and phable and easy to handle. In an atmosphere of high humidity, it is necessary to vulcanize a bonded part as soon as it is prepared because adhesion drops considerably as the humidity increases. Buchan shows that a bond of 900 lbs. per sq. in. was obtained at a humidity of 23% which at 40% dropped to 800 lbs. and at 55% to 300 lbs. He also mentioned that Cycleweld cements should not be applied if the humidity is over 75%.

The testing of a bond without destroying the part has always confronted the rubber engineer. The safest precaution is to first test the batch of rubber for bond prior to its release to production. Some inspection departments use special jigs whereby the unit force exerted on the bonded part to cause rupture is determined and then a percentage figure of this force is used to test the bond. Manufacturers who have X-ray equipment are studying bonds through this medium, but as long as the rubber forms around the insert no faulty adhesion can be detected. Others are using high voltage currents, and in a few restricted places some are placing the part under a low tension or shear stress while it is subjected to supersonic waves. How this latter test is performed is not known.

Buchan mentions in his book one concern which brass plates all their inserts, tests the brass plated surface with one part of a 1% solution of sulfur and carbon disulfide mixed with four parts of a 1% solution of stearic acid and benzol. If a color is formed which is dark yellow at first, changes to orange, then to brown and then to a greenish brown, the brass plate will produce a satisfactory bond.

The following table gives the relative bond strengths obtainable with different types of rubber on the same metal and different types of metal with the same rubber:

	Natural Rubber	GR-S	GR-I	GR-M	Buna-N
Al	G	G	P	G	E
B Iron	G	G	P	G	G
Brass	G	G	F	G	G
Bronze	F	P	P	F	G
Cadmium	G	G	P	G	G
Copper	G	F	P	G	G
G Iron	G	G	P	G	G
Lead	P	P	P	F	P
Steel	G	G	P	G	E
Tin	P	P	P	F	G
Zinc	F	P	P	F	G

Since many bonded parts operate at excessive high or low temperatures, the following prepared by Buchan is most interesting:

Temperature °C.	Bond Strength P. S. I.
+ 150	500
+ 100	680
+ 50	750
+ 21	813
0	915
— 20	1091
— 30	1116
— 40	1243
— 50	1817
— 55	2506
— 60	2770

To the rubber engineer who is confronted with adhesion problems from time to time, it is recommended that Buchan's book entitled "Rubber to Metal Bonding" be obtained and studied. It is published by the London Crosby Lockwood & Son Ltd. and can be obtained through local book stores. Vanderbilt's 1948 Handbook and the Hycar Blue Book are also recommended to those interested in the subject.

Questions and Answers

Question No. 1—What is the effect of oil, high temperatures, and low temperatures, and also the effect of vibration on a bond?

Answered by Mr. Reynolds: Oil will not affect a good bond providing that the compound itself is moderately oil-resistant. The compound should reach maximum swell without showing any deleterious effect on the bond. Oil, regardless of its aniline point, should never cause separation between metal and rubber, however severe its action might be on the rubber itself. Low temperature should not affect a good bond. We test our bond in a tumbler at —108°F. High temperature, even to a point where carbonization takes place and the compound becomes brittle, should not loosen the bond.

The effect of vibration on a bond can be interpreted in two ways. First, as the part itself is subjected to vibration that is induced while the part is working in a different plane. A good example would be a soft valve set where vibration has been set up by changes in pressures or fluttering. Second, by using the part as a vibration isolator to damp vibration between the excitor and some shock-free instrument which is common in mounting most aircraft instruments.

Question No. 2—What is the effect of aging on bonds?

Answered by Mr. Akers: I think that has been pretty well answered by some of the data Mr. French has presented. In general, bonds improve on aging. This is true only under the condition that the metal under the bond isn't deteriorating. Stated differently, if the metal under the bond starts to rust or otherwise become corroded, the bond naturally will fail. This condition has actually been recorded in some cases where neoprene is put directly on iron and steel. If one brass plates first and then covers the part with neoprene or uses a Parlon type cement on the metal, rusting should be reduced to a minimum.

Where a part is defective it can be often stripped off fairly easily when it is quite fresh. After a part has been in use for a long period of time it is very difficult to get it off, and many times one can hardly burn it off. This is true in tank lining particularly. A fresh tank lining can be pulled off with fair ease, but after it has had considerable aging it is very difficult to remove.

Question No. 3—What is the comparison of the strength of a molded bond with a wrapped, overcured bond?

Answered by Mr. French: If the correct procedures are used for bonding metal to rubber either in a mold or in a vulcanizer, one will find that the bond will be comparable. For example, if one compares a strip test on a molded part and a part that has been placed in open steam without any wrap the bond strength will be in the neighborhood of 60 to 70 lbs. on a one-inch sample. The spiral wrapping does not necessarily give a better bond but it will prevent any porosity in the stock and reduce blisters to a minimum. In the curing of large covered inserts it is advisable to first heat up the vulcanizer.

A longer cure at a lower temperature is better than a high temperature cure; however, the cure must be adjusted for the thickness of the covering. It is very important that when the end of cure is reached the vulcanizer be slowly blown down and compressed air introduced to maintain the same pressure as during cure and held until the part is approximately 160°F. If it is possible to place sprays into the vulcanizer so that the water can hit the insert itself it will help considerably in lowering the temperature of the insert and prevent any blow.

Question No. 4—What is the simplest method of securing adhesion of natural rubber to steel without plating in a small plant operation?

Answered by Mr. Shor: I don't think there is any simple method; however, the easiest method is to use ebonite, and cement, or sandblast the part to be covered and use a chlorinated rubber cement.

Question No. 5—When you consider chlorinated rubber do you feel one coat of chlorinated rubber is sufficient or is it desirable to have a cover cement over that?

Answered by Mr. Shor: It depends on the nature of your stock. If it is tacky enough, there is no need for a cover cement. However, the bond strength is increased by using the cement over the chlorinated rubber.

Question No. 6—What is the relative strength of bonds in shear, tension and compression?

Answered by Mr. Reynolds: Where the load factor remains constant, tension rates highest, shear second and compression lowest in severity of action on the separation of metal from the rubber. We have taken advantage of this fact in several designs and have found that certain compounds can be used where before they could not.

Question No. 7—What suggestions have you on bonding neoprene or Hycar compounds for —65° F. service to steel or aluminum?

Answered by Mr. Reynolds: Neoprene and Hycar compounds that will withstand —65° F. can be bonded to steel or aluminum with commercial cements. I am not aware of a Hycar compound that will perform at this temperature for very many applications.

Question No. 8—What effect would some of the low temperature plasticizers have?

Answered by Mr. Reynolds: The only one I have had experience with is phosphate.

Question No. 9—What would you say about other plasticizers?

Answered by Mr. Reynolds: They would have no effect.

Question No. 10—Will Butyl bond to steel, brass or aluminum?

Answered by Mr. French: Butyl will bond to brass provided the brass plating contains 70% copper and 30% zinc. Recently R. W. Kaercher of the Case Institute of Technology, Cleveland, Ohio, presented a talk to the American Can Co. of Maywood, Ill., on the bonding of Butyl rubber to brass. He gave many worthwhile suggestions on this one subject, which one will find worth investigating. Mr. Buchan also covers the making of bonding Butyl cements in his book mentioned earlier.

Question No.11—What is the time limit allowable between the operations of sand-blasting, degreasing, cementing and molding? Roughly, what time limits would you recommend? Are there any time limits between these various operations?

Answered by Mr. Akers: It sounds like you are degreasing after sand-blasting. I prefer degreasing before sand-blasting if the sand is clean. In the case of aluminum and stainless steel, particularly, a coat of adhesive cement, whatever it may be, must be put on almost immediately after sand-blasting. Aluminum and stainless steel do not corrode, but a protective oxide coating forms on the treated metal very rapidly. This coating is deleterious in getting a good bond, so directly after sand-blasting, Ty-Ply or a phenolic resin or whatever cement you are going to use should be placed on it.

After putting on your first coat of cement, the essential thing is to let it thoroughly dry. Cements usually contain an aromatic solvent such as toluene which requires a drying time of 30 minutes to an hour; after this a cover cement can be used if necessary. Once the part is cemented you don't have to worry a great deal then as long as you keep the cemented surface clean.

If the rest period is too long the tie cement loses its tack, but, of course, you can always put on another layer of tie cement if you want to freshen it prior to molding. If the Ty-Ply stands much over an hour, it begins to get a glaze effect. Whether this is an oxidation process or the nature of the cement, the bond is not as strong as it would be if it were treated with a tie cement. In molding, especially if you are wrapping a tie gum around it, then you have protected all your cementing areas. You can stack them for 24 hours or longer. You might have to freshen your tie gum for molding, but your worries are more or less over if you are using a tie gum. Get it on immediately and then your storage problem isn't too important.

Question No. 12—What is the relative increase in total bond strength obtained over a smooth surface by diamond or straight line knurling? What are the limits on fineness?

Answered by Mr. Shor: Well, actually I think that question should be worded the other way around. A polished smooth surface definitely gives a better chemical bond than a machined or knurled surface.

Question No. 13—Have you compared a smooth surface or a polished surface against a machined surface? And, how would you compare a polished surface against a sand-blasted surface?

Answered by Mr. Shor: If the sand-blasting is done with a very fine grit, you will find better adhesion than with a coarse grit. In other words, a polished surface again is indicated.

Question No. 14—Will you outline a procedure for bonding latex to metal?

Answered by Mr. French: The bonding of latex to metal is no different than the bonding of rubber or synthetics to metal. Latex used for bonding contains 45% solids. The part to be bonded should be sand-blasted and then covered with Vulcalock cement prior to the latex dip. The part is cured in open steam or in hot air although the air bond is not as good. Latex shrinks 40 to 50%, a fact which must be considered, especially on articles which have concave sides or rounded corners. As an illustration, no trouble is experienced in bonding latex to the outside of a test tube, but considerable trouble would be experienced in bonding the inside due to the pulling away of the latex film from the corners.

Question No. 15—What type of bonding cement and method of application is most satisfactory for bonding a Buna N-polyvinyl chloride compound to steel?

Answered by Mr. Reynolds: Ty-Ply BN or phenolic cements should be satisfactory for bonding Buna N-polyvinyl chloride compounds to steel. A low content polyvinyl chloride compound should provide a better bond at high temperatures inasmuch as it is thermoplastic. It has been proven that the lower the P.V.C. content the better the bond.

Question No. 16—Is there a satisfactory method of repairing rubber-to-metal bond failures in fully cured parts?

Answered by Mr. Akers: It depends upon the surface. If the article is very critical and if the defects are very large it is better to remove the entire covering and start all over again. If the area is small it can be repaired. Cut out the defective material and buff the metal with either a grinding stone or a sanding wheel, and then repaint with a bonding cement. Work a faster curing repair stock into the recess using care that not too much stock is placed in the defective area.

Question No. 17—How effective are infra-red lamps for rapid drying of cements on inserts?

Answered by Mr. French: Infra-red lamps will dry cement very rapidly; however, it should not be left to the human element to turn them off. The light should be connected to a timer to guard against a cured surface film. If an uncured film does form, there is a possibility that it may prevent the solvent from evaporating which may cause blisters to form at the bonding junction. The safest precaution is to let the cements air dry slowly in a room free from dust.

Question No. 18—Is it possible to secure the same degree of adhesion between anodized aluminum and Buna N as is obtained when aluminum is sand-blasted?

Answered by Mr. Shor: I believe the answer would be "yes" if the anodization is carefully done. If the proper precautions with respect especially to low humidity are taken, you can get a better bond with an anodized surface on aluminum then with sand-blasting.

Answered by Mr. French: I might add to that, if you sand-blast and then anodize, the bond sometimes is better than either single operation.

Question No. 19—What cements are best in bonding neoprene to steel?

Answered by Mr. Reynolds: Ty-Ply S cement has proven adequate for bonding neoprene to steel when the hardness ranges between 55 and 75 Shore durometer.

Question No. 20—What do you do when you get below the 55 Shore range that you mentioned?

Answered by Mr. Reynolds: We would go into our own cements there, especially when the part is subjected to vibration.

Question No. 21—Would you use that over a Ty-Ply or exclusively without using Ty-Ply first?

Answered by Mr. Reynolds: It is used exclusively in the preparation of metal and stock.

Question No. 22—Will a GR-S black loaded hose stock show copper deterioration if it is cured in contact with a bronze-coated steel wire?

Answered by Mr. French: It is doubtful if the copper in the bronze would cause a GR-S stock to deteriorate due to the fact that the accelerator Cumate used in GR-S compounds has no poisoning effect on GR-S stocks.

Question No. 23—What is the best procedure and the best bonding agent for bonding a cold GR-S compound similar to a camelback with a hardness of 60 to an aluminum die casting?

Answered by Mr. Reynolds: I would recommend a Ty-Ply Q cement for bonding a 60 Shore GR-S cold rubber tread stock to an aluminum casting. Most castings are not preheated sufficiently to remove all the oil and consequently if one bonds a stock to them without treatment the adhesion is not satisfactory. A mixture of xylene and benzene has proven to be one of the best solvents for removing oil from aluminum castings when Ty-Ply Q cement has been used as the bonding medium.

Question No. 24—What procedure would you use for bonding GR-S, natural, or neoprene stocks to chrome-plated rolls?

Answered by Mr. Shor: The chrome-plated roll should be sand-blasted, Ty-Plyed, with the correct type, and as a rule you will not experience any difficulty in securing a fairly good bond.

Question No. 25—Is it possible to bond all types of rubber, including those plasticized heavily? If so, describe in detail.

Answered by Mr. Akers: Eliminating Butyl, which is very difficult to bond, most all other types of rubber in any degree of Shore hardness can be bonded. The problem will have to be very specific. How good a bond do you want? In some cases, a strip adhesion of 8 to 20 lbs. is considered sufficient. In other cases a bond of 50 lbs. is required, and for extreme cases a strip adhesion of 100 lbs. is required.

One of the easiest ways of checking your adhesion is to pull the rubber off in a 1" wide strip from the metal surface. You can do this by hanging weights on it or by the use of the Scott machine. A good average pull figure is around 50 lbs. If you get near the 100 lbs. mark you have a very excellent bond. If you want to convert that over to lbs. per square inch, you can use a factor between 8 and 10.

Question No. 26—What is the best method of bonding nitrile rubbers to metal? What precautions should be used?

Answered by Mr. Reynolds: Cleaning and handling and timing have been used up to this time. We like to use timing in a different way, and recommend a phenolic cement. You have to be very careful on timing from the time it is sand-blasted and the first coat is painted on. We recommend two coats. The part should be heated and cured at 320° F. Let it set 30 minutes before molding, being certain that flow is reduced to a minimum.

Question No. 27—What is the best method of bonding natural or synthetic rubber to cast or sheet magnesium?

Answered by Mr. Reynolds: Use Ty-Ply Q after sand-blasting.

Question No. 28—What are the relative advantages of a cement bond and a brass plating method? Would you comment briefly on the advantages and disadvantages of each?

Answered by Mr. Shor: As far as Ty-Ply goes, it certainly is cheaper than brass plate, and it certainly is simpler; however, the ultimate bond that you could get with brass plate must always be taken into consideration. If the end product is worth it, a brass plate should be definitely considered. A brass plate is both age and heat resisting, and with Ty-Ply it is questionable. The surface treatment of brass plating will not wipe off under the flow of rubber during vulcanization, but there have been definite cases in Ty-Ply bonding where this has been the case. Personally, we feel that brass bonding is better than Ty-Ply.

Answered by Mr. Akers: We have one plant which uses a great deal of brass plating. In our local plant we use various types of cements, and if carefully handled I believe you can get equal bond with either type. The only thing I want to point out is that with neoprene on Ty-Ply, you may have trouble with corrosion underneath which weakens the bond. Other than that I would say in my experience you can get an equal bond with either type.

Hoisting Line for Latex Samples

THE choice of the correct type of hoisting line to attach to a sampler for usage in latex is often a nuisance problem. Small twine easily becomes knotted while larger cord, such as sash cord or clothesline, soon becomes an expense item because of its short life due to the inability to remove the dried film from the cotton fibers. Chain is often used but it, too, becomes increasingly difficult to clean and is finally discarded long before it is actually worn out. Thin, flexible steel cable is almost as hard to clean as chain because the dried film becomes gummy in the strands of the cable.

Latex and Rubber, Inc., of Baltimore, Maryland, has found a type of line which is extremely easy to handle, i.e., plastic clothesline. This material is easily cleaned and it can be wiped off while wet or allowed to dry, in which case the film can be easily peeled off. Another advantage is that the line does not foul so as to slow down the taking of samples in rapid succession.

Silicone Rubber—A Literature Review

By JOHN B. GREGORY

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UNKNOWN thirteen years ago and offered on the market for only seven years *(12)*, silicone rubber has already reached the big business stage. Chief factor in this phenomenal growth, considering the high price of the compounds (10 times natural rubber or GR-S), is the unique range in service temperature possible (—100° F. to 500° F.) *(1)*.

Silicone rubber is a high polymer made up of dimethyl siloxane units with the following structural formula *(9)*:

$$\begin{matrix} CH_3 & CH_3 & CH_3 \\ -Si-O-Si-O-Si-O- \\ CH_3 & CH_3 & CH_3 \end{matrix}$$

Its high temperature resistance appears to be due to the strength of the —Si—O—Si— backbone *(3)*, 89.3 kg-cal per mol as compared to 58.6 for the —C—C— bonds in conventional rubber *(23)*. The stability of the molecule to oxidation, owing to the lack of chemical unsaturation, is also a factor in its heat resistance. Its unique suitability for temperature extremes is demonstrated by noting its change in hardness with temperature.

Silicone rubber can be compounded so that it has a hardness change of less than 25% between —70° F. and 480° F., a spread of 550° F. *(29)*. Such a compound is only twice as hard at —100° F. as at normal temperatures. None of the carbon skeleton rubbers are in the same class in this respect. Those few natural or synthetic rubber compounds which are flexible at —70° F. *(5)* are not sufficiently heat resistant to be used for long at temperatures above +150° F. without pronounced degradation. The heat resistant polyacrylic elastomers which withstand 300° F. for prolonged periods *(2)* are not resistant at low temperatures and become brittle at temperatures of —30° F. even if plasticized *(87)*.

Silicone rubber compounds are milled on conventional rubber equipment, as shown in this view. (Photo courtesy of Dow Corning Corp.).

Silicone rubber burns to a white, nonconducting ash while conventional rubber burns to carbon, an electrically conducting material. This principle is important in the design of cable for use in ships. (Photo courtesy of General Electric Co.)

The small change in hardness with temperature characteristic of silicone rubbers is considered to be analogous to the relatively small change in viscosity with temperature of the silicone oils *(11)* and is explained by Fox et al as being due to the ability of the silicone rubber molecules to coil and uncoil reversibly as helices. They postulate "the opposing action of two molecular mechanisms: (a) the effect of increased temperature in separating the molecules causing the viscosity (modulus in case of solids*) to decrease, and (b) the effect of increasing temperature in lengthening the helically coiled polymers causing the viscosity (modulus*) to increase" *(4)*. This unusual ability to coil appears to be due to the highly flexible nature of the Si—O bond as compared to C—C or Si—C *(21)* and to the negligible barrier to free rotation about Si—O bonds *(16)*.

The Si—O bond results also in low intermolecular attraction *(24)* and gives rise to the chief deficiency of the silicone rubbers, their low ultimate tensile strength and low tear resistance. The molecular weight of these rubbers, at one time considered to be low because of their low tensile strength, has been found to be of the same order as that of other synthetic rubbers *(15, 17)*. This low intermolecular attraction, on the other hand, is doubtless also responsible for the failure of some of the silicone rubbers to crystallize down to —123° C., the second order transition point for this type of elastomer *(22)*. This is said to be the lowest temperature at which such a transition has been observed in a polymer.

* Author's note.

Preparation of the Rubber

The first step in the preparation of silicone rubber is the synthesis of dimethyldichlorosilane which may contain small amounts of monomethyltrichlorosilane and trimethylmonochlorosilane. The two methods reported to have been used for large scale production are essentially as follows:

(a) Grignard Method:

$$SiCl_4 + 2CH_3MgCl \longrightarrow (CH_3)_2SiCl_2 + 2MgCl_2$$

(b) Direct Method:

$$Si + 2CH_3Cl \xrightarrow{\text{Cu catalyst}} (CH_3)_2SiCl_2$$

Both of the above reactions in actual practice produce a mixture of the mono-, di-, and trimethylsilanes. Careful control of the reaction and distillation of the product is required to produce dimethylsilane of the desired purity. Rochow gives an extensive discussion of these syntheses in his book on silicones *(11)*.

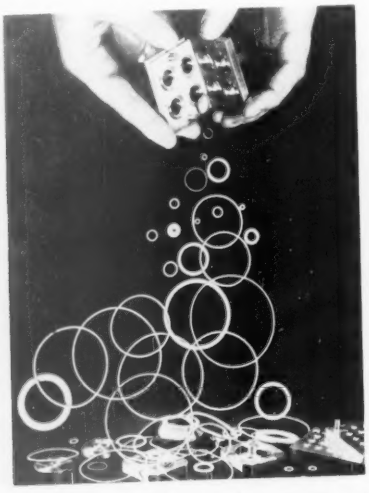
Once the dimethyldichlorosilane has been prepared it is then polymerized to a silicone oil by hydrolysis. This can be done by mixing the silane with water or weakly alkaline solutions *(11, 18, 24)* but better control appears to be possible if the silane is poured onto the swirling surface of an electrolyte with a specific gravity of about 1.1. The electrolyte specified is a water solution of a salt of one or more of the metals in groups 1 and 2 of the periodic table with Cl^-, CO_3^{--}, SO_4^{--}, NO_3^-, etc. The silicone oil thus produced is said to contain less than 10% of polymer boiling below 200° C. The amounts of mono- and trimethylsilane which may be copolymerized with the dimethyldichlorosilane is specified in several patents *(33, 38, 42, 46)*.

The oil is then further polymerized to a rubbery gum. A variety of methods of accomplishing this step are mentioned in the literature *(26, 29, 35, 36, 37, 38, 42, 43, 45, 47, 49, 52, 53, 55, 56, 58)*. The procedure mentioned most frequently is treatment of the oil with ferric chloride ($FeCl_3$ or $FeCl_3 \cdot 6H_2O$). To produce $FeCl_3$-catalyzed gums of the highest heat stability, after-treatment by two phase hydrolysis (water and a solvent for the silicone) *(27)*, or by addition of litharge *(30, 31, 81)* appears to be necessary. We have observed that gums said to be $FeCl_3$-catalyzed have a yellow tint.

Recently both suppliers of silicone rubber compounds have released materials which have improved tensile together with high elongation *(56, 68, 83, 84)*. U. S. Patent 2,541,137 claims a product with tensile of 1203 p.s.i. and elongation of 700% *(56)*. The polymers in both instances are said to be made by further polymerizing the dimethylsiloxane oil with KOH *(56, 88)*. The gum produced in this instance is water white *(82)* and requires no litharge in compounding *(82)*. To attain the good physical properties mentioned above, 3.5 parts on 100 parts of gum of a finely divided silica with a pore volume of 5.6 cc/gram and a heat of wetting of 0.74 cal/cc pore volume were used. The curing agent used was 0.4 parts by weight of tert-butyl perbenzoate. Finely divided silicas are also recommended by the other supplier to attain similarly high physical properties with their KOH type gum *(82)*. The commercial product recommended in this instance is Santocel C made by the Monsanto Chemical Co. Further compounding is then conventional. Fillers such as Celite Super Floss may be added to increase hardness and mercuric or mercurous oxide may be incorporated to gain improved compression set *(88)*.

A first cousin to the silicone gums is silicone bouncing putty. This is made by treating a dimethylsilicone oil with a boron compound such as boric acid plus heat and finally kneading with a filler such as titanium dioxide *(57)*. The resultant product is highly elastic under suddenly applied stresses and highly plastic under slowly applied stresses so that it will bounce as well as the best gum rubber ball and yet if allowed to rest on a piece of fabric will flow into the cloth under its own weight. Its peculiar properties have been exploited as novelties for children under the name Silipatty, as golf ball centers, and in a gadget used to adjust the length of table legs to compensate for uneven floors.

Bouncing putty is thought to owe its peculiar properties to its structure. This is thought to be a two-phase system comprising a highly cross-linked silicone network with hydrophobic methyl groups attached to the silicone atoms and a viscous hydrophilic liquid reaction product of the boron compound and some of the methyl silicone oil. The friction between the hydrophilic and hydrophobic groups is high when the material exhibits "bounce" under suddenly applied stresses because the groups are locked, but the material flows readily under slowly applied pressure because the internal friction is overcome *(57)*.



This view shows a number of silicone rubber O-rings and other small parts, as compounded and molded in conventional flash molds by the Frederick S. Bacon Laboratories.

Compounding and Vulcanizing

As with various of the ordinary synthetic rubbers, the silicone rubbers must be compounded with filler to bring out their best properties. Care must be taken that the filler itself is inert and heat-stable. Various fillers reported to be useful are titanium dioxide (DuPont R510), lithopone, Celite 505 (Johns-Manville), Dicalite PS (Dicalite Co.), Isco Pure Silica Carara No. 1240 (Innis Speiden and Co.) *(81)*, Celite Super Floss *(82)*, and Alon (Godfrey L. Cabot, Inc.) *(6)*. Carbon black, the outstanding reinforcing pigment for most rubbers, gases badly at 200° C. *(3)* and causes difficulties in vulcanization *(9)*. The particular filler to be used depends upon the application. Titanium dioxide, Celite 505, and Dicalite PS are said to be excellent for molding purposes whereas lithopone is more useful for extrusions. Compounds containing Silica 1240 can

be either molded or extruded and give low compression set *(81)*. The silicas are reported to give the best electrical properties *(9)*, and Alon to be useful for high tensile strength *(6)*.

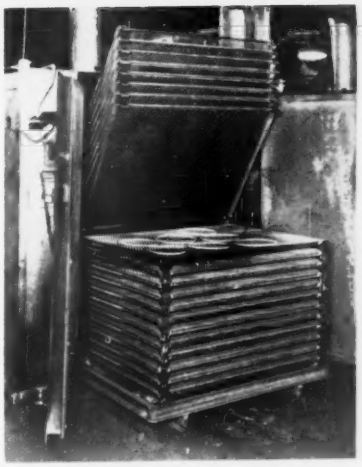
Vulcanization of the silicone rubber is generally accomplished by use of benzoyl peroxide *(6, 81, 82)*. Tertiary butyl perbenzoate may also be useful where a slightly higher curing temperature is desired *(6, 81)*. The incorporation of mercuric oxide is used where compounds having maximum resistance to permanent set are desired *(32, 68)*. Other vulcanizing agents mentioned in the literature are the zirconium nitrates $ZrO_2 \cdot N_2O_5$ and $ZrO(NO_3)_2 \cdot 3H_2O$ *(36)*. Improved permanent set is also claimed for silicone rubbers made from dimethyldichlorosilane copolymerized with some vinylmethyl- or divinyl-chlorosilane *(44)*.

A small amount of stearic acid may be incorporated with the benzoyl peroxide *(81)* but large amounts, as a processing aid in calendering, will cause poor heat aging and discoloration. If stearic acid must be used it should be applied to the calender rolls in small amounts *(67)*.

In compounding a formula comprising gum, filler, benzoyl peroxide, and litharge, if required, conventional rubber compounding equipment can be used. In milling, the roll temperatures recommended vary from 120° to 160° F. depending upon the stock being run *(81, 82)*.

Fabrication of the stocks is extensively covered in the technical literature published by the suppliers of the silicone rubbers *(59-86)*. They may be molded, extruded, calendered or solution coated. The principal difference between the handling of silicone rubbers and conventional rubbers is in the method of vulcanization. Most silicone stocks require an initial cure at 260° F. for 3 to 8 minutes under pressure, followed by an air cure for up to 24 hours at 480° F. *(67)*. A few stocks have such good properties after the preliminary cure that for some uses the long air oven cure may be reduced or even eliminated *(83, 84)*. If the cross sectional thickness of the molded part is greater than $\frac{1}{8}$ inch, it is customary to employ an intermediate cure at lower temperatures before going to 480° F.; otherwise blowing and bubbling occur. Shrinkage of silicone rubber stocks may run as high as 8% so that care should be taken to allow for this in mold design *(67)*. Five per cent solutions of alkyl sulfates such as Dreft (Procter and Gamble) and Vel (Colgate-Palmolive Peet Co.) are recommended for mold release, since silicone oils used for most rubbers are not effective with silicone rubber *(67)*. Extrusions are generally given an initial steam cure *(48, 67)*.

Steel rolls as long as 78 inches are currently being covered with silicone rubber. These rolls are used both for their unique release properties and for their ability to withstand continuous use at 340° F. (Photo courtesy of Stowe-Woodward, Inc.)



Silicone rubber parts are cured in circulating hot air ovens after molding. (Photo courtesy of Manhattan Rubber Division, Raybestos-Manhattan, Inc.)

Silicone rubber can be friction-calendered onto glass, asbestos, or metal fabrics, and even onto cotton, Nylon, or Orlon. Inorganic fabrics should be free of organic sizings *(67)*. Compounds for use on organic fabrics should contain extra accelerator and cannot be fully cured due to the inability of the organic fabrics to withstand the 480° F. needed to develop maximum properties in the silicone rubber *(67)*. Such coated organic fabrics offer some definite advantages, however, because the silicone rubber imparts waterproofness, water repellency, weather resistance, good dielectric properties, and greater resistance to chemicals and oxidation *(67)*. Doede et al have shown that reinforcement of the silicone rubber is possible by laminating with glass fiber. Data from swelling tests indicate that the adhesion of the rubber to the glass is strong enough to partially balance the swelling pressure *(3)*.

By compounding with a silicone rubber of relatively lower molecular weight, it is possible to produce pastes containing no solvents with Williams plasticity values as low as 10 *(82)*. Such pastes can be applied to fabrics by doctoring, spreading, or roller coating, and when fully cured will have properties comparable to the conventional compounds *(65, 68)*. These pastes are also useful for mechanical sealing or caulking *(65)*. They are, of course, easily reduced if need be; aliphatic, aromatic or chlorinated solvents are suitable *(61, 65)*. As the fillers in the silicone rubber compounds settle less in the high gravity chlorinated solvents, their use is generally preferred.

Clean silicone rubber scrap can be reworked by milling on a warm mill (130° F.) until it forms a sheet, and gradually working in fresh stock on cold rolls; up to 30% of scrap may be used *(67)*.

Some information is available as to methods of bonding silicone rubbers to other materials, especially metals *(64, 72, 73, 85)*. After cleaning the surface to be bonded, the silicone rubber may be molded directly against the surface, or the surface may first be precoated with a silicone resin. Bonds as strong as the rubber itself have been claimed although reports from

fabricators indicate that there is room for an improved process.

Silicone rubber sponge can be made by use of a blowing agent such as Unicel ND or by steam vulcanization followed by an immediate oven cure, or by accelerating the normal evolution of gases during initial vulcanization. Doubled volumes can be achieved by sponging *(70)*.

Physical and Chemical Properties

The physical and chemical properties of the silicone rubbers are summarized roughly as follows *(68)*:

Ultimate tensile	about 800 p.s.i. max.
Elongation at break	250 p.s.i. max.
Shore Hardness	10 to 90
% Compression set at 300° F.	as low as 10 on some stocks even at this temperature
% Compression set at −50° F.	as low as 50 on some stocks
Brittle point	less than −110° F. on some stocks; all stocks less than −70° F.
Dielectric strength	up to 800 volts/mil
Dielectric constant 10^2 c.p.s.	as low as 3.2
10^6 c.p.s.	as low as 3.0
Power factor 10^2 c.p.s.	as low as 0.002
10^6 c.p.s.	as low as 0.002
Resistance to weathering	little change after 3½ years outdoors even when under stress; little change in electrical properties
Chemical resistance	resistant to most bases, weak acids, salt solutions and aliphatic oils; outstanding for oil resistance at high temperatures
Thermal conductivity	about twice that of organic rubbers
Specific gravity	1.2 to 2.6
Coefficient of expansion (no filler)	40×10^{-5}/° C. between −35° and 0° C. *(22)*

The above figures indicate the silicone rubbers to be outstanding for service at both temperature extremes, especially for gasketing where resistance to compression set or hot oils is desired. Their good electrical properties coupled with unusual resistance to ozone cracking when under stress *(76)*, their high surface resistivity even under moisture condensing conditions *(29)*, and the fact that, due to their chemical nature, carbon tracking cannot occur after dielectric breakdown *(3)*, make silicone rubbers ideal for dielectrics.

Typical Applications

Aside from the high price which prevents them from competing with conventional rubbers where they give satisfactory service, the main drawback to the use of silicone rubbers is their low tensile strength at normal temperatures. At high temperatures where the physical properties of other rubbers are poor, the comparison is much more favorable. This low tensile results in low tear and abrasion resistance, however, so that there are applications, such as moving seals in contact with hot oil, where the conventional rubbers are still used, in spite of their short life under these conditions. Should a filler be found which would reinforce silicone rubber as carbon black reinforces ordinary rubbers, new fields would undoubtedly open for its use.

As would be expected from their resistance to temperature extremes, the chief uses for the silicones are in the aircraft industry, one of the uses being gaskets for turbo-superchargers *(76)*. Other aircraft uses are in rocker box gaskets for heating and ventilating ducts when reinforced with glass cloth, push rod housing seals *(68)*, and O-rings *(77)*. Silicone rubber extrusions are used in the Convair B-36 where parts must remain flexible at the −100° F. occasionally encountered at 40,000 feet and where parts of the plane operate continuously at 450° F. *(68)*. The very poor adhesion of ice to silicone rubber surfaces has indicated its use for de-icers *(65)*.

In the automotive industry, silicone rubber O-rings are used to seal fluid transmission units on some of the better quality automobiles due to their superior resistance to oil at 350° F. and for gasketing the push rod tube assembly on the air-cooled ordnance engine designed by the Continental Motors Corp.

Industrial uses that have been mentioned are capacitor bushings for operation in contact with chlorinated diphenyl, gaskets and seals in steam irons, sealing outdoor floodlights and military search lights, sealing high vacuum systems used in coating optical lenses, as seals (when reinforced with glass cloth), for corner joints in the walls of boilers fired with pulverized coal, as roll coatings for hot and cold dipping of fabrics, plastic film and metal sheeting, and for heat-sealing cellophane packages *(68)*.

Electrical uses include Navy intercommunication cable requiring operability over a 15-foot length for 3 hours in contact with a gas flame, ignition cable on ordnance vehicles, and in high altitude planes. Silicone rubber pastes are used to imbed coils and strip heaters. Glass tape coated with semi-cured silicone rubber is useful as the outer wrapping for field coils, armatures, transformer coils, and solenoids. These are fully cured by a short bake after wrapping *(68)*.

Conclusion

As the unique properties of silicone rubber become more widely recognized, it doubtless will be used as a replacement for inferior materials in more and more instances. The possibilities of new uses where no previous material was satisfactory, open up even greater potentialities. It is hoped that this article will stimulate still further the current interest in silicone rubber and that the bibliography covering the major publications on this new material will be helpful.

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DIRECTORY LISTINGS

AS indicated in the Preface to the 1951-52 RUBBER RED BOOK, it is almost impossible to publish a directory of more than one thousand pages without the possibility of error. These errors will be called to the attention of users of the directory through the medium of this column so that corrections can be transposed to copies by those desiring to do so. A few corrections follow:

Page 12—Ace Rubber Products, Inc.—Eliminate R. C. Myers as secretary-treasurer and general manager. F. C. Snyder is now president, treasurer and general manager; Charles J. Snyder is secretary and assistant general manager.

Page 56—L. A. Dubow Manufacturing Co.—Change title of Phillip Kalowski to factory superintendent, golf ball plant. Eliminate Dorothy E. Neyens. Add Harry Dubow as secretary.

Page 162—U. S. Rubber Co., Textile Division—Change title of William A. Singleterry from general manager to control manager. (Make same change on Page 951). Add William E. Clark as general manager.

Page 462—Transfer listing of Wyandotte Chemicals Corp. from "Blanc Fixe" to "Calcium Carbonate" section.

Page 658—Include listings of Marbon S, S-1 and 8000 in section on "Other Rubberlike Materials." These were inadvertently omitted. These materials, produced by the Marbon Corporation, Gary, Indiana, are modified high styrene resins which can be used by themselves or as reinforcing agents.

Page 814—Change title of Paul W. Becker from Factory Manager to Plant Manager, Wire & Cable Division, Electric Auto-Lite Co., Hazlelon, Penna.

Page 886—Change title of W. Kesteloot from Plant Engineer to Plant Manager, Wire & Cable Division, Electric Auto-Lite Co., Port Huron, Mich.

Page 916—Eliminate listing of R. C. Myers.

Photoelectric Interferometer for High Polymer Research

A RECORDING photoelectric interferometer recently developed by Dr. R. N. Work of the National Bureau of Standards at Washington, D. C., greatly simplifies the determination of transition temperatures in natural and synthetic rubbers and other high polymers. The fully automatic instrument observes and plots the varying length of a polymeric sample against temperature over the range from —185° to +185°C. Transition temperatures are then readily obtained as discontinuities in the plotted curve or in its slope.

The new interferometer was developed in connection with a broad program now under way at NBS which has as its object the design of new polymers having specified characteristics. A knowledge of the temperatures at which transitions take place in these materials is needed in order to predict the temperature range over which a given polymer will have useful mechanical properties. An important current phase of the program which is being sponsored by the Office of Naval Research relates to the development of low-temperature rubbers for use in the arctic or in high-altitude flight. Rubbers become brittle or stiff as they undergo transitions at low temperatures, and NBS is seeking data that will aid in relating these changes to the molecular structure of the rubbers.

Several years ago the Bureau applied the interferometer to the location of transition points, using it to measure changes in the length of a polymeric specimen with varying temperature. In this type of application, three thin specimens are placed so as to separate two optically flat, transparent plates that are illuminated with parallel, monochromatic light perpendicular to the plane of their faces. If the plates are nearly parallel, the light reflected from the bottom surface of the top plate interferes with that reflected from the top surface of the bottom plate either constructively or destructively to form a pattern of interference fringes. Now, if the thicknesses of the specimens change with a variation in temperature, the separation of the plates will be altered, and there will be a corresponding variation in the fringe pattern as shown by a motion of the fringes. The fringes are observed in a suitable optical system, and the number passing a given point in the field of view is counted. Then the change in separation of the plates at the point of observation, and hence the change in length of the specimen near that point, is given by the following relation:

$$\Delta l = \frac{\Delta N \lambda}{2}$$

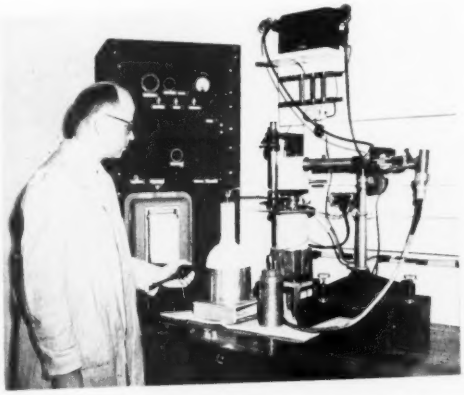
where Δl is the change in separation, ΔN is the number of fringes passing the point of reference, and λ is the wavelength of the light used.

Because the visual interferometric method requires the continuous and undivided attention of an operator, it has not been widely adopted. To avoid the tedious counting of fringes, various photographic methods have been tried. However, these methods all involve the processing of photographic film, and the data must still be plotted by hand. The NBS photoelectric interferometer eliminates all hand operations, presenting the plotted data on a record chart in a form suitable for immediate determination of transition temperatures and for estimation of coefficients of expansion.

In the NBS device, a photomultiplier tube is used to detect the changes in light intensity at a reference point in the fringe pattern as the fringes move past this point. The amplified output of the tube is automatically plotted against time on a strip chart recorder, which is useful in monitoring the phototube output. A switch actuated by the recorder movement produces a current pulse upon the passage of each fringe. This current pulse actuates a mechanism which moves the chart of a second recorder a unit distance for each fringe. At the same time the pen of the second recorder is actuated by changes in the temperature of the specimen, as indicated by the emf of a thermocouple embedded in a piece of material similar in size to the specimen and similarly located. Since changes in fringe count are proportional to changes in length, the record on the second recorder provides a plot of length of specimen versus temperature.

In the interferometer constructed at NBS, a helium tube is used as a source of light. After traversing an iris diaphragm, which limits the effective size of the source, the light is rendered parallel by a lens and is then deviated and dispersed in passing through a Pellin-Broca prism. By changing the orientation of the prism, light of a wavelength corresponding to one of the spectral lines in the source may be made to fall perpendicularly upon the interferometer plates, which are located at or near the focal plane of the lens. The reflected light returns along nearly the same path to form an image of the source at the iris diaphragm. The image of the interferometer with its interference fringes is observed through a converging lens system.

For a satisfactory fringe pattern, the interferometer plates must be parallel within a few wavelengths of light.



View of the recording photoelectric interferometer developed by the Bureau of Standards which greatly facilitates the determination of transition temperatures in high polymers.

Otherwise too many fringes will be observed, making counting difficult or impossible. To adjust the plates more easily for parallelism, quartz wedges are placed between the lower interferometer plate and the sample. The separation of the plates can then be varied slightly at each of the specimens by moving the corresponding wedge in or out. This adjustment can be made while the specimen holder is enclosed in a thermostat. Use of the wedges simplifies considerably the preparation of the specimens, permitting wider tolerances in their thicknesses.

The NBS photoelectric interferometer is particularly well adapted to survey work where transitions must be located rapidly in a large number of materials. The data can be processed with a minimum of effort, and a precision of ±0.5°C or better in the location of transition points can be realized. Values of coefficient of expansion thus obtained for rubberlike materials are reproducible to at least ±5 percent.

(EDITOR'S NOTE: For further technical details the reader is referred to Research Paper No. 2230 entitled "A Photoelectric Recording Interferometer for Measurement of Dimensional Changes." Copies of this paper are available from the National Bureau of Standards, Washington, D. C.).

Dual Effectiveness of Polymeric Resin in Compounds

THE plastics, coating, textile, packaging and other industries which use vinyl films are currently harassed by the tight supply of cadmium and lead stabilizers. Accordingly, the dual effectiveness of a low-viscosity polymeric resin as both a plasticizer and a stabilizer offers significant opportunities. In view of this situation, the following data supplied by the Rohm & Haas Co., of Philadelphia, Penna., should prove of interest:

Laboratory testing by the Resinous Products Division of Rohm & Haas Co., fortified by actual field results, indicates that Paraplex G-60 exerts a definite stabilizing action in addition to its primary function as a plasticizer. Polyvinyl chloride films plasticized with this resin and containing no stabilizer whatever show surprisingly good stability, though the addition of some supplementary stabilizer is generally recommended. But, it has been demonstrated, the presence of G-60 as a plasticizer permits the quantity of stabilizer to be halved, even for the most rigorous conditions of processing and exposure. The stabilizing action of Paraplex G-60 has been confirmed not only by accelerated laboratory tests, but also by actual Florida exposure studies.

The effectiveness of this resin as a plasticizer has been amply established. A typical PVC stock plasticized with 35 percent G-60 has, for example, a 100 per cent modulus of 1860 psi. And the Shore "A" hardness test (10 seconds' contact) yields an average value of 76. With this same stock, no extraction loss occurred in 1 percent soapy water after 24 hours' exposure at 60°C. After 60 hours at 93° C., extraction loss was still less than 3 percent, about one-fourth of the average loss for such films plasticized with dioctyl phthalate. Extraction loss in mineral oil after 10 days at 25°C. for the stock tested above was 4.2 percent of sample weight, and no loss was recorded after 10 days in tap water at 25°C.

Low volatility of the G-60 resin was demonstrated in tests using activated carbon. After 24 hours' contact with activated carbon at 90°C., the same stock as above showed a loss of 0.3 percent.

A significant economy achieved by the stabilizing action of this resin is its "up-grading" of other plasticizers which, without the addition of the Paraplex, are unacceptable from the standpoint of stability. As little as 10 to 20 percent of the G-60, it is asserted, will accomplish this result with such plasticizers as phosphates, glycol derivatives, phthalates and amide types. Often, results indicate, this use will develop appreciable savings by permitting the utilization of low-cost plasticizers, even under stringent service requirements.

Heat stability of a polyvinyl chloride film with and without Paraplex G-60 added is expressed in the following table:

STABILIZATION EFFECT OF G-60 ON POLYVINYL CHLORIDE STOCK

Formulation	Parts		
Geon 101	100	100	100
Paraplex G-60	0	0	50
Phosphate-type plasticizer	50	50	0
Stabilizer	1.5	4.0	1.5
Heat stability (hours)*	¾	¾ to 1½	Over 4

* Time required at 350° C. to produce marked discoloration.

An added advantage also results because the Paraplex plasticizer is considerably lower in density than vinyl film, which is sold on the bases of square yardage and thickness. Thus, scarce supplies of vinyl chloride are stretched to the limit.

Successive plant expansions, the most recent having occurred only a few months ago, have tripled production capacity for this resin, and raw material supplies appear adequate to meet anticipated needs.

McGraw-Hill Directory of Chemicals and Producers: 1952. Edited by Thomas L. Bonnitt. Published by McGraw-Hill Publishing Co., Inc., 330 West 42nd St., New York 18, N. Y. 6 x 9 in. 626 pp. $20.00

This is the second edition of McGraw-Hill's chemical directory. Like the first, it includes only certified prime producers of chemicals with their products broken down into grades and purity and including such information as synonyms, trade names, packing, shipping regulations, shipping points, etc. It has, of course, been completely revised, with some 20,000 changes made (additions and deletions). An important new feature has been added, i.e., the names and titles of key executives of the companies, their divisions and/or departments are now shown. Products covered in this directory include heavy, industrial and fine chemicals, dyestuffs and intermediates.

Kraystay. Phenix Pabst-Ett Co., 460 East Illinois St., Chicago, Ill. 8½ x 11 in. 18 pp.

Kraystay is a trade name covering the dehydrated edible gelose extract of the natural seaweed Irish Moss or of Gigartina mamillosa. This product has a number of unusual properties and is finding application in a number of commercial and industrial uses. This booklet has been prepared to acquaint potential users with the chemical and physical properties of the product and to indicate its already widespread application. Among subjects covered are viscosity and concentration effect of heat, compatabilities, effect of pH, effect of acids, and the effect of hydroxy compounds. Specific applications in the drug and cosmetic, food and beverage industries are discussed and some indication of uses in a number of other fields. Among the latter are the use of Kraystay in latex and in adhesives.

Editorials . . . . . .

Latex Paints

SALES are rapidly mounting on the new type of ready-to-use, easily applied, water-thinned indoor paints which give a smooth but rubberlike coating. The coating is generally washable and the paints come in a variety of decorator colors. They are answering the clamor of the do-it-yourself school. Extensive advertising campaigns on these new type paints have been launched by leading paint manufacturers, including the Glidden Co., which calls its "Spred" the "100% latex emulsion paint", and the Pittsburgh Plate Glass Co., which is pushing "Wallhide," the "rubberized satin finish." Sherwin-Williams was one of the first in the latex-base paint field when it introduced its Super Kem-Tone early last year.

These new latex-base paints come ready to use and are as nearly foolproof as possible. The householder who tackles an inside paint job for the first time requires little or none of professional or semi-professional equipment. The paints need only to be stirred and applied. The brush or roller need be prepared only by wetting with water and dipped into the paint, and can be cleaned later by simply washing with water. The paints can be rolled or brushed on to wood, wallboard, plaster, or wallpaper. Even the rankest amateur can produce a professional-looking job. Temperature conditions can be practically ignored. Prime coats or other undercoatings are rarely necessary. With all of these obvious advantages, can the tremendous potentiality of these paints be missed?

Paint manufacturers have been somewhat at a loss to name and describe this new development in paint technology in layman's language. The unorthodox, commonly called cold-water paints had been misunderstood, and the poor performance of some of the brands placed on the market had weakened the promotional possibilities of pushing a water system of paint. All of these facts were recently reported on the subject by the *Sindar Reporter*, popular house organ of the Sindar Corporation. The article also raised a rather moot question on these same paints, viz: Why the name "latex" or "synthetic rubber emulsion" paint?

Latex, as understood by the technologist and accepted by the layman, is descriptive of a suspension of rubber particles in a liquid medium. It is true that the term is also occasionally applied to some other products, such as milk, which is also a suspension of small particles in liquid, but to the average layman the term is still associated with rubber—and rubber alone. This type of system can, of course, be produced synthetically. Synthetic rubber itself is produced from a butadiene-styrene latex slurry. The new paints contain latices, but these latices are water dispersions, or a type of emulsion, of various high molecular weight polymers, such as styrene-butadiene, polystyrene, and related types.

Although sales of these new type emulsion paints are expanding rapidly, the development is still in the embryonic stage, and there is still time for the paint manufacturing industry to adopt a more appropriate term, with greater consumer significance, for such paints. The importance of a proper term will become even greater in the future, since there is a definite race in the paint field at the moment to develop an emulsion type, water-base paint for outdoor use, one which can be mixed with water and applied on any surface, standing up under all climatic conditions. This is an even bigger market than the indoor paint field, and some of the larger paint companies are fairly close to successful formulations.

We have no definite objections to the use of rubber terms in describing the new paints, nor any specific suggestions for new or better terms, but we believe it would be to the advantage of the paint industry to seek and adopt more descriptive terms for these paints now than regret the terminology at a later date.

Company Rankings

SEVERAL months ago the Federal Trade Commission completed and sent to Congress a special report on the 1,000 largest American manufacturing concerns. The study, which was made in connection with the proposed strengthening of the anti-trust laws, was based on sales and assets in the 1945-46 period. On this basis, Goodyear was ranked the biggest of the rubber companies, with Firestone, U. S. Rubber and Goodrich next in order. In the over-all ratings, however, Goodyear was 27th, Firestone 32nd, U. S. Rubber 39th, and Goodrich 44th. The study also indicated that the Standard Oil Co. (N.J.) was the largest concern, with DuPont, often regarded as the symbol of "big business", in 6th place.

Twelve additional rubber concerns were among the 1,000 covered in the survey. These companies, in order of their size, were as follows: General Tire, Lee Rubber, Dayton Rubber, Seiberling Rubber, Thermoid, Mansfield Tire, Hewitt-Robins, Armstrong Rubber, American Hard Rubber, Dewey & Almy, Pharis Tire (since liquidated), and the Boston Woven Hose & Rubber Co. In total ranking, General Tire was 180th and Seiberling 599th.

These figures prove little, other than the fact that in the 1945-46 period at least sixteen rubber manufacturers were among the nation's first 1,000 top producing concerns. If another survey was made on the basis of 1950-51 figures, the chances are that a few more rubber companies would join the list. Goodyear, which is expected to top $1,000,000,000 this year, would still head the list.

CURRENT NEWS OF THE MONTH

GSA MAINTAINING 52c NATURAL RUBBER PRICE AS OPS AUTHORIZES RISE IN SYNTHETIC LATEX

THE General Services Administration has announced that the price at which it resells natural rubber to industry will be maintained at least through November 30. The Office of Price Stabilization took the action by approving GSA's request that the present schedule, pegged at 52c a pound for No. 1 Ribbed Smoked Sheet, be continued through November. The prices were originally established on July 1, when GSA cut its selling price by 14c a pound. Meanwhile, the seven private firms which distribute government-made synthetic liquid latex to industrial consumers in less than carload lot quantities were authorized to increase their prices by 1.5c a pound effective October 17. The price boost was authorized by OPS in Amendment 1 to Supplementary Regulation 57 of the General Ceiling Price Regulation. In effect, the amendment permits these distributors to pass on the 1.5c increase granted last September 1 to the Reconstruction Finance Corp., sole producer of the material.

RFC handles carload sales to industry itself, but distributes less than carload lots through seven firms which it has licensed to handle smaller quantity shipments. Most sales of synthetic latex, which finds its outlet chiefly in foam products, are made in less than carload lots.

The special action was made necessary because SR 29 to the GCPR, which permits automatic pass-on to wholesalers of price increases granted to manufacturers, does not cover ceiling price increases granted under the GCPR. The automatic pass-on regulation applies only to price advances authorized under the various manufacturing ceiling price orders, such as CPR 22.

May End Latex Role

A government decision to drop exclusive buying of natural rubber latex is expected shortly along with announcement of a plan to sell its current stocks to industry, trade sources report. An interagency rubber group recently agreed to recommend this course to Defense Production Administrator Manly Fleischmann. The actual date at which GSA will cease buying imported liquid latex, however, is yet to be determined.

The Munitions Board and other agencies are close to a final decision to give up the latex put into the stockpile to date, or en route here from overseas, and to buy no more. The problem, however, is to get agreement from the dealers and industrial users to take present stocks off the government hands. The government started to stockpile latex about 11 months ago.

The government is said to want to get out of the natural rubber latex picture because of a vast expansion now under way by the RFC to nearly double the production of synthetic latex. The government is convinced that the United States will soon have ample supplies of a synthetic product at least the equal in quality of the high-priced, imported natural latex. RFC, now producing about 30,000 tons of latex a year, plans by conversion and expansion to reach 50,000 tons a year, most of it of the "cold rubber" type.

Difficulty in getting dealers and manufacturers to take over the moderate government stocks of natural latex is foreseen, because natural latex has virtually priced itself out of the market for foam rubber goods. Consumption dropped sharply last spring because of the high price and the NPA, noting the downtrend, dropped all curbs on this use of natural latex this fall.

GSA hopes to come up with the trade's answer on whether it will buy the government's stocks within a short time. The decision will have no bearing on the stockpiling of dry natural rubber. The Munitions Board probably will try to replace the natural latex with other grades of dry natural rubber.

The original decision to stockpile natural latex came at a time when industrial demand was high and stocks in this country or afloat were under 30 days' supply. Today, total stocks, including latex contracted for by GSA and afloat to this country, equal three months' supply. Some strings may be attached by the government when it drops the exclusive buying of imported latex. It may set a floor on stocks held by industry, possibly in the neighborhood of 60 days' supply.

GSA is reported to be screening all manufacturers' orders of natural rubber for November delivery in accordance with the 90-day inventory provision of NPA. This may result in many factory orders for November being cut back or turned down, according to trade reports. The screening committee has been comparing manufacturers' November requirements with Form 328 which lists each manufacturers' inventory of all grades of rubber and also consumption. Orders are cut if the amount of rubber ordered brings the inventory position above 90 days.

In the trade, views on the government action are two-sided. It is argued that the major control is the end-use control. Therefore, it does not matter whether a manufacturer has a natural rubber inventory of 60 days or 90 days or more. The government itself has been experiencing a little difficulty with storage facilities. Therefore, the more natural rubber that manufacturers have, the less will be the pressure on storage space, trade sources maintain.

Trade sources further state it may well be to the advantage of the government to permit much larger inventories for manufacturers. Should an emergency arise, this rubber automatically would revert to government ownership, but would be in a position for use, thereby saving considerable time and expense. The important factor is to get the rubber into the United States, and not whether it is locked up in stockpile or in the hands of manufacturers or dealers.

Use of Rubber Residue

In Amendment 1 to Order M-2, dated October 18, 1951, NPA acted to stimulate purchases of the rubber residue material which accumulates in the production of synthetic rubber. NPA said the residue is satisfactory for use in making many types of rubber products, either by itself or in combination with specification synthetic rubber.

In the amendment, NPA eliminated residue material from its definition of synthetic rubber, thus removing it from any allocation control. Heretofore, a purchaser of the residue material had to charge it against his synthetic rubber allocation at a rate of 25%. That is, if he bought 1,000 pounds of the material, he charged 250 pounds against his synthetic rubber quota.

NPA explained that the residue accumulates in the RFC synthetic rubber plants in this manner: In the various stages of the manufacture of synthetic rubber, the material coats the containers, forms film on the machinery or coagulates more quickly than normal. When a sufficient amount of this residue is accumulated, it is either treated in the plant and sold as refined GR-S residue or it is sold without treatment as unrefined GR-S residue.

In order to increase the sale of GR-S residue materials, RFC has established

uniform processing procedures for handling the materials in the plants. RFC has also made arrangements with rubber reclaiming companies to process these materials in accordance with its instructions. A description of the materials and the processes through which they are passed, follows:

Plant Clean-Up—This material consists of dried latex drammgs, coagulum, dryer cleanings, floor sweepings, uncompounded laboratory scrap, prefloc, etc. The material is blended, washed, dried, strained and screened through a number 10 screen in the case of unpigmented polymers and a number 8 screen in the case of pigmented polymers. It is then baled. It may contain fine dirt and other foreign particles which could pass through the screen. The material is sold for 23.4c per pound, plus the applicable uniform freight charge. It is charged to the purchase allocation and consumption quota on a 50% basis.

Refined GR-S Residue—This material consists of products similar to those which go into plant clean-up but which, due to their nature, are not suitable for processing as plant clean-up. It also contains flash tank cleanings, sump cleanings, etc. The material is processed by either of the two following methods:

(1) That processed in RFC plants is blended, washed, dried, strained and screened through a number 10 screen in the case of unpigmented polymers and a number 8 screen in the case of pigmented polymers. It is then baled. It may contain fine particles of dirt and other foreign material which could pass through the screen.

(2) That which is sent to an outside rubber reclaiming company is washed, dried and refined on a mill set at .002 inch. Consequently, it may contain particles of foreign materials which could pass through a .002 refiner.

Both the material processed in RFC plants and that processed by outside reclaiming companies is sold for 20.8c per pound, plus the applicable uniform freight charge.

Unrefined GR-S Residue—This material consists of the same products which go into refined plant residue as described above. However, it has not been processed in any way, is of various moisture contents and may be contaminated with foreign material. It should be reclaimed either in the purchaser's plant or in a rubber reclaiming company before use in end products. This material is priced according to its moisture content, as follows:

Moisture Content (Maximum Allowable)	*Price Per Pound (in cents)*
5%	14.04
10%	13.27
15%	12.51
20%	11.74
25%	10.98
30%	10.21
35%	9.45

The prevailing uniform freight charges (not included in the prices above) are applicable to the gross shipping weight of the above described materials.

In the past the materials now designated "refined GR-S residue" and "unrefined GR-S residue" have been charged to purchase allocation and consumption quotas on a 25% basis, as stated previously. They may now be purchased without such charge.

Research Personnel Needed

The Naval Air Material Center, Philadelphia 12, Penna., is in need of professional personnel, particularly technologists in the field of research and development of elastomeric materials. Interested parties are requested to contact F. C. Bolles, Jr., Commander, USN, Industrial Relations Officer, Naval Air Material Center, Philadelphia 12, Penna.

GR-S Incentive Plan

To accelerate the evaluation and commercial acceptance of oil-extended GR-S, RFC, on April 24, 1951, established an incentive plan which was approved by the NPA Rubber Division. Oil-extended polymers produced in government-owned plants are presently designated X-628, X-629, X-646, X-654, X-660, X-661, X-663, X-668 and X-669.

The plan provided that any company could buy up to 300,000 pounds (net RHC content) per month of oil-extended GR-S without charge to its cold rubber allocation. This did not permit an increase in the company's total allocation of GR-S but did allow the company to obtain additional cold GR-S, since oil-extended synthetic is made from a cold rubber base.

The commercial acceptance of oil-extended GR-S has been satisfactory and the present demand exceeds existing production capacity. There are still many companies that have not yet evaluated these polymers. In view of this, states the RFC, it would appear advisable to retain an incentive plan but the quantity a company may purchase without charge to its cold rubber allocation should be reduced.

Accordingly, the RFC and NPA have determined that effective with permits issued for the month of November, the maximum quantity of oil-extended GR-S which a company may obtain without charge to its cold rubber allocation shall be 60,000 pounds (net RHC content) per month.

At the same time the aforementioned incentive plan was established, RFC, with the approval of NPA, effected a similar plan with respect to X-632, a 95-5 butadiene-styrene polymer which preliminary data indicated might be a substitute for Butyl rubber in the manufacture of inner tubes. X-632 has not proven to be satisfactory in this respect and the incentive plan applicable to this polymer has been discontinued.

ORR Undergoing Reorganization

RFC is seeking a new chief to direct its $750,000,000 synthetic rubber operations. Gerald B. Hadlock, executive director of ORR, who has had the top job since 1946, is shortly expected to be transferred to a staff position as advisor on synthetic rubber to RFC's Office of Production. The Office of Production, headed by Arthur Barrows, is in charge of synthetic rubber, tin smelting and abaca fiber operations for the agency.

A spokesman said RFC is looking for an executive from a rubber company or some related industry to succeed Mr. Hadlock. ORR, under a topside reorganization of the agency, has been redesignated as the Synthetic Rubber Division of the Office of Production. RFC contemplates no other changes in the division.

Its new chief, when selected, will report directly to either Mr. Barrows or to James Reid, recently named as technical director of the production office. RFC said that Messrs. Barrow and Reid will handle production office authority interchangeably. Mr. Reid, on loan from the Phillips Petroleum Co., was director of production until succeeded by Mr. Barrows a short time ago.

Thiokol Put on Allocation

NPA, on October 19, announced the allocation of Thiokol. Thiokol is being allocated as an Appendix A material by issuance of Schedule 10 to NPA Order M-45, a basic chemical order which establishes the mechanism for allocating scarce materials. Because Thiokol is being classified as an Appendix A material, it will be necessary for both the supplier and the purchaser to make monthly applications to NPA for permission to buy or sell. November was designated as the first allocation month.

An important characteristic of Thiokol is that it flows freely and affords rapid sealing over a wide range of temperatures. Its use in military planes and its other applications have created a heavy defense demand that has amounted to 300% of the production in recent months.

With the military demands so great, civilian uses of Thiokol were stopped entirely. The action was taken in an effort to make a little of the supply available for essential civilian consumption. These include the manufacture of pressure tapes, industrial and electrical appliances involving heat gaskets, brake bands and diaphragms for gas meters.

NPA said that through allocation it would be able to help regulate the military uses by screening requests in order to suggest substitute materials, help arrange delivery schedules and to take other action aimed at making certain that the fullest possible use is being made of the short supply.

Purchasers will file NPAF-45 by the fifteenth of each month preceding the month of delivery. Suppliers will file Form NPAF-46 by the twentieth. For the November period, however, forms were to have been filed as quickly as possible.

Rubber Machinery in Decline

The steady decline in the production of machinery to process rubber poses a serious threat to future defense orders for such items as airplane tires, rubber life rafts and tires for military vehicles, NPA was told recently. The Rubber Processing Machinery Advisory Committee, at a meeting with NPA officials, recommended that greater output of such machinery

be supported by the government so that industry, if expansion should be deemed necessary later, could increase the manufacture of rubber processing equipment.

At present, most of the industry is shifting to the production of other more defense-related machinery. There is no difficulty getting direct defense orders, industry spokesmen said. Production of rubber processing machinery has been handicapped not only by small allotments of materials, but also by component shortages, most notably electric motors and anti-friction bearings.

NPA officials, while reporting that the motor shortage is likely to continue, said bearing production is being expanded and a considerable improvement in supplies is expected early next year. The supply of aluminum for molds is also expected to improve, NPA officials said, but not until the latter part of 1952.

An informal survey of the committee showed that about 60% of present output in the industry is for rated orders, with the bulk going for maintenance, repair and operating (MRO) purposes. About 15% is for export.

Chemical Production Jumps

Domestic production of a wide variety of chemicals during the first six months of 1951 increased considerably over the output during the first six months of 1950, NPA announced recently. NPA said these increases were important because chemicals are used directly or indirectly by virtually all industries, either as a basic raw material or as a processing agent.

According to NPA, production of styrene in the first six months of 1951 was 323,322,000 pounds, 38% more than the 234,854,000 pounds produced in the first half of 1950. Some 829,000,000 pounds of ethyl alcohol were produced in the first half of 1951, 35% more than the 615,000,000 pounds produced in the first half of the preceding year. Phenol production, both synthetic and natural, was set at 180,730,000 pounds in the first half of this year, 27% more than the 142,752,000 pounds produced in the first half of last year.

Standard Oil Co. (Indiana) recently announced it has started commercial shipment of benzene produced from petroleum in a new plant at its Whiting, Ind., refinery. Until recently, benzene was almost exclusively a by-product of coke, the company explained, but a nationwide shortage of the chemical led to its development from petroleum.

The Whiting plant will produce about 11,000,000 gallons of benzene annually, the company said. Expansion, planned for completion in the second half of 1952, will raise capacity to 16,000,000 gallons.

In a move aimed at alleviating the critical shortage of sulfur and its most important compound, sulfuric acid, the Shell Chemical Corp. has announced plans to add to its Houston, Tex., operations a unit for recovering sulfur from waste refinery gases. Output of the unit will be sold for conversion to sulfuric acid.

The new sulfur recovery unit, certified by the government as a necessary defense project, is expected to be completed by mid-1952. In the recovery process, waste refinery gases, containing hydrogen sulfide, carbon dioxide and a small percentage of light hydrocarbons, will be burned and catalytically converted to sulfur at an annual rate in excess of 13,000 tons.

New Pricing Method Established

The Office of Price Stabilization on October 3, set out more clearly how manufacturers of certain new rubber products determine their ceiling prices. The methods are detailed in Amendment 3 to Supplementary Regulation 8 to the Manufacturers' General Ceiling Price Regulation, CPR 22. SR 8 prescribes a series of industry-wide percentage cost adjustment factors which a manufacturer applies to his base period prices in determining his new CPR 22 ceilings.

The factors cover more than one hundred categories and product lines, including such items as rubber hose, thread, tape, belts, lining, latex foam and chemically blown sponge, various molded, extruded and lathe-cut products, footwear, heels, soles and many dipped products.

The new amendment to SR 8, effective October 8, 1951, does not provide a new pricing technique. Rather, it is aimed at clearing up confusion by restating an earlier interpretation on pricing new rubber commodities listed in SR 8 by reference either to a comparison commodity or to a competitor's ceiling price.

Though the procedure was not spelled out heretofore in SR 8, the regulation indicated that when a manufacturer priced a new product which he did not make in the base period—and therefore did not have a base period price to which to apply the adjustment factor—he used one of the various methods available in CPR 22 to determine his ceiling. Because there has been some confusion as to the precise method of calculating prices of new commodities, Amendment 3 to SR 8 outlines this procedure in greater detail.

It stipulates that the manufacturer, if possible, selects a comparable commodity which he has priced under SR 8. He determines the percentage markup over current unit direct costs represented by the ceiling on the comparable commodity, and then applies the same percentage markup to the current cost of the commodity to be priced in accordance with the procedure of Section 32, CPR 22.

If he makes no comparable commodity from which he may obtain a ceiling in this manner, the manufacturer uses the most closely competitive seller's ceiling determined for the product under SR 8, in accordance with the provisions of Section 33, CPR 22. If neither of these methods is available, the manufacturer may apply to OPS for a ceiling price in accordance with the provisions of Section 34, CPR 22.

Pricing Option Extended

According to OPS, the option of pricing certain molded, extruded and cut mechanical rubber goods under GCPR has been extended until further notice for manufacturers who have chosen to price other products under the Manufacturers' General Ceiling Price Regulation, CPR 22. This option applies to all products whose sales volume in the second quarter of 1951 was less than $10,000, except for hydraulic brake cups and parts, hydraulic boots, molded tires, automobile floor mats, and platens for typewriters and business machines.

Manufacturers' ceiling prices for polyvinyl chloride resins will continue at the levels prevailing under GCPR, OPS stated recently. Provision for maintaining the ceiling prices at which manufacturers were frozen on January 26, 1951, is contained in Amendment 30 to CPR 22, the Manufacturers' Ceiling Price Regulation, effective October 15, 1951.

The new amendment merely adds polyvinyl chloride resins to the list of commodities in Appendix A of CPR 22 which are excluded from control of CPR 22, thereby leaving polyvinyl chloride resins under GCPR.

Members of the Rubber Chemicals Industry Advisory Committee have recommended to OPS that a tailored regulation be issued to cover their industry. Committeemen indicated that a regulation would be satisfactory which employed industry-wide percentage cost adjustment factors, applicable to prices established under GCPR, and which would cover new cost increases. The industry is confronted with rises in the cost of aniline and other raw materials.

Reduce Original Equipment Tires

Without any fanfare or public announcement, tire companies supplying new car manufacturers cut 2½% from the prices of tires ranging in size up to 8.25 by 20 and 5% from the price of larger sizes. The full range of new car equipment tires came in for the price reductions. It is understood one company initiated the move early in October, and all the others followed.

No change has taken place in the retail price of replacement tires, nor is one anticipated, according to a spokesman for one of the companies. Original equipment tire prices are reviewed every six months. The price tags were increased substantially last March when natural rubber was selling for 60¢ a pound.

OPS, on October 26, amended the provisions of CPR 64, Tire Mileage Service, to permit continuation of certain existing contracts at levels established under GCPR. CPR 64 provides that ceilings for tire mileage service be determined by employing the base rates prevailing during the period December 19, 1950, to January 25, 1951, adjusted upward or downward at regular accounting intervals to reflect increases or decreases in the cost of rubber, rayon and cotton.

In cases where existing contracts did not contain escalator clauses, provisions for such upward and downward adjustment were required to be filed with OPS by September 1, 1951. Because a rise in the cost of rubber, rayon or cotton could bring about a situation wherein the operator might be required to pay more than his previously contracted price, Amendment 1 to CPR 64, effective October 31, 1951, has been issued, permitting existing contracts without escalator clauses to remain in effect until the expiration date or next renegotiation date, whichever is earlier.

FIRESTONE FINANCING INTRODUCED AS EVIDENCE IN ANTI-TRUST TRIAL

For the past several months a Federal Court in New York City has been hearing an anti-trust action brought by the government against 17 leading banking firms. Recently, the Firestone Tire & Rubber Co. was cited by the government to support its contention of a conspiracy by these 17 firms to refrain from competition for the financing business of the company. Federal Judge Harold R. Medina said he detected "considerable scrambling going on" for the financing business of the company.

The comment by the court came after an attorney for Harriman, Ripley & Co., a defendant in the anti-trust action, had submitted evidence intended to show that at least five other defendants were seeking the Firestone financing or had been consulted by it between 1935 and 1938. The Harriman-Ripley firm on October 26, 1938, headed the underwriters group in the Firestone financing.

Joseph P. Ripley, a partner in the firm bearing his name, in a deposition, stated that he had approached the late Harvey W. Firestone in 1935. Mr. Ripley recalled that as an executive of the defunct National City Co. he had put in a "terrific amount of overtime" to expedite the $60,000,000 financing by Firestone, which resulted in a $10,000,000 loss to the investment bankers because "the ink was no more dry on the underwriting contract than the market began to crack."

Mr. Ripley's deposition said that Firestone, in 1935, had promised him the business and that he felt confident thereafter his firm, then known as Brown, Harriman and Co., would succeed. Mr. Ripley, in a memorandum in 1935, told of the conversation with Mr. Firestone in which the industrialist spoke of being "overwhelmingly bothered" by other investment bankers seeking the business.

Mr. Ripley, in his deposition, mentioned Edward B. Smith & Co., Glore, Forgan & Co., and Blyth & Co. Other documents showed that Kuhn, Loeb & Co. had sought the business and that Morgan, Stanley had been consulted by Firestone.

Judge Medina questioned a government attorney on its theory that the other defendants deferred to Brown-Harriman because it was the successor firm to the National City Co., and therefore had traditional banker rights. The government attorney contended that Blyth and Brown-Harriman then had claims to the business formerly done by the National City Co., and in that case perhaps the principle of successorship would not operate.

It was stated, however, that the government felt Brown, Harriman primarily was the successor to the National City Co. and under the government's theory all other defendants should have deferred to that firm.

Master Builders Co., Cleveland 3, Ohio, has issued a bulletin describing new methods for the installation of floor brick and heavy tile. Called the Embeco Method, this procedure is being used by many tile contractors.

Named Chemicals Division Manager

John R. Lill

John R. Lill, formerly associated with the Mutual Chemical Co. of America as production superintendent and assistant to the plant manager, has been appointed manager of the new Chemicals Division of the J. M. Huber Corp. The newly-formed division will supervise and expand the manufacture of pigments, accelerator activators and other chemicals used in rubber processing. Headquarters of the division will be at Borger, Texas. A graduate of Johns Hopkins University, Mr. Lill has been a practicing chemical engineer for the last 12 years.

Ensolite Used in Boxing Mat

A new boxing ring mat, designed to bring greater safety to boxers, has been developed for the New York Boxing Commission after months of research by Edward Dye of the Cornell Aeronautical Laboratory, Inc. Introduced in Syracuse on September 18, it was trucked to the Polo Grounds for the Saddler-Pep featherweight title match on September 26. The mat is topped with a crash-resistant material called Ensolite, which was made by United States Rubber Co. according to Mr. Dye's specifications. It is a cellular composition with unusual shock-absorbing qualities. Under the Ensolite is one inch of Cellotex. Members of the New York Boxing Commission and Mr. Dye believe the new mat is a definite safety step that will reduce the chances of shock to the brain and fracture of the skull if a man hits the mat.

Plan Philippine Tire Production

The Jacinto Rubber and Plastics Co. of Manila, P. I., has announced the purchase of $250,000 worth of machinery for the manufacture of rubber tires. The company has also purchased $100,000 worth of textile weaving machinery which will be used to weave canvas for the manufacture of rubber shoes. It is hoped that the new fabric, ramie, can be utilized instead of imported cotton. With the equipment on order, the company proposes to manufacture 50 truck tires and 50 automobile tires a day.

RUBBER USE SEEN INCREASING BY U. S. RUBBER BOARD CHAIRMAN

An increase of 30% in the per capita consumption of rubber in the United States by 1960 was predicted by Harry E. Humphreys, Jr., chairman of the board and president of the U. S. Rubber Co., at a recent meeting with a group of editors and writers in New York City. Mr. Humphreys, noting that 1951 consumption is estimated at approximately 1,250,000 tons, or about 18½ pounds per capita, forecast that in 1960 consumption of rubber would be up to 24 pounds per person.

Pointing out that Congress originally intended the government to stay in the rubber business only temporarily, he expressed the hope that the government would soon get out of the business. He suggested that the government lease its synthetic rubber plants to private companies, and let rubber prices revert to the influence of supply and demand. Mr. Humphreys reported that the rubber industry's sales have now reached the $5,000,000,000 level, with annual profits around $250,000,000, or about 5% of total sales.

Available rubber in 1952 is expected to exceed consumption by more than a quarter of a million pounds, Mr. Humphreys said. The industry expects to have a supply of 1,680,000 tons, and consumption will total about 1,400,000 tons, including approximately 960,000 tons of synthetic rubber and 440,000 tons of natural rubber.

Of the total consumption, it is believed that not more than 20% will be required for defense products. Therefore, more rubber will be available for civilian goods than in 1951, unless some unforeseen requirements develop, he said. In 1951, about one-third of a million tons of rubber was added to the nation's strategic stockpile, he reminded. Slightly more than 12% of the rubber now being consumed is going into defense products. The remaining 88% is just about keeping step with increased demand for civilian goods.

This year's total rubber consumption will be about 63% synthetic rubber and 37% natural rubber. This ratio strengthens arguments of manufacturers for consideration of some plan for leasing the government-owned synthetic rubber plants to private operators, he said.

Plant Maintenance Show Speakers

Manly Fleischmann, administrator of the Defense Production Administration, will head a group of 56 speakers in the most extensive discussion of plant maintenance problems ever undertaken, to be held at the Plant Maintenance Conference, Convention Hall, Philadelphia, January 14 to 17, 1952. The conference, which will be held in conjunction with the Plant Maintenance Show, is sponsored by the American Society of Mechanical Engineers and the Society for the Advancement of Management. Highlight of the conference will be its division into more than 30 separate sessions in order to accommodate special talks on individual industry needs and to permit executives to discuss problems that arise in plants of varying sizes and varying maintenance needs.

RUBBER SECTION OF NSC HOLDS INTERESTING CHICAGO MEETING

The Rubber Section of the National Safety Council, meeting in conjunction with the parent organization in Chicago, Ill., on October 8-12, elected new officers for the 1951-1952 season and heard a number of interesting papers. G. H. Burkhardt (General Tire) was elected general chairman for the new season with R. M. Boyles (Midwest Rubber Reclaiming) as vice-chairman in charge of program. R. W. Fickes (Goodyear) was elected secretary of the section. F. W. Sands (U. S. Rubber) was named news letter editor for the new season. The following members were named to the various committees of the Rubber Section:

Engineering, W. J. Dooling (Hood Rubber), chairman, and J. L. Dean (Firestone) and A. R. Pomeroy (Ohio Rubber); *Trade Association and Liaison*, C. E. Beck (St. Clair Rubber), chairman; *Health*, Dr. R. H. Wilson (Goodyear), chairman, and K. A. Kelson (Goodyear) and Dr. W. L. Hogue, Jr. (Firestone); *Membership*, T. I. Cain, Jr. (Goodrich), chairman, and H. L. Andrews (Firestone) and S. A. Wright (Inland Mfg.), co-chairmen.

Publicity, C. E. Frick (Van Cleef), chairman; *Rules and Regulations*, G. D. Cross (Firestone), chairman, and J. J. Raytkwich (Naugatuck Chemical); *Statistics*, F. T. Reynolds (Akron University), chairman; *Manufacture of Synthetic Rubber*, W. M. Graff (U. S. Rubber), chairman, and K. B. Davis (Goodrich Chemical), E. R. Bonner (Kentucky Synthetic Rubber), and W. E. Kavenagh (Goodyear).

Papers Presented at Meeting

Among the many interesting papers presented at the meeting was one by M. R. Batche, safety and service director of the Xylos Rubber Co. Mr. Batche stated that management must assume primary responsibility for the plant safety program. He pointed out that a successful safety program will include indoctrination of all new employees in accident prevention and a continuing educational program through posters, company publications, motion pictures, contests, safety literature and regular meetings with supervisors. However, he said, no safety program can succeed unless everyone in the plant, all the way from management on down, puts a shoulder to the wheel and makes a full contribution.

R. Verne Righter, manager of the Saginaw, Mich., malleable iron plant of the General Motors Corp., reported to the Rubber Section that a good safety program has tremendous advantages. Mr. Righter said that a plant with a good safety record not only enjoys greater respect from employees but also occupies a stronger position in the community. He explained that accident prevention not only seeks out and corrects possible causes of mishaps but provides improved working conditions which can only be reflected in an improved safety record.

In his address, R. S. Farnum, safety engineer for the Detroit, Mich., plant of the U. S. Rubber Co., spoke on power truck safety. Mr. Farnum pointed out that proper selection of truck drivers is an important part of an accident prevention program. Elevator operators required to move trucks on and off elevators usually can be turned into good truck drivers. The best safety device, Mr. Farnum opined, is a safe operator.

Prevention and control are the two acts most necessary to reduce the hazard of fires from solvents in the rubber industry, said William J. Dooling, safety engineer of the Hood Rubber Co., in his paper at the Rubber Section Meeting. Mr. Dooling applauded the rubber industry for the progress it has made in reducing the number of fires from solvent materials, but he urged a continuing effort to train employees in steps to take when such fires occur in spite of all preventive action.

Cites States' Responsibility

J. Ward Keener, vice-president of the B. F. Goodrich Co., reaffirmed the responsibility of the states to enact safety control measures and questioned the federal government's right to intrude. Accident prevention must be localized and personal to be effective, he said, and any tendency toward centralized control and direction must be resisted.

John R. Kumpel, URWA representative from Akron, spoke for labor and observed that when labor and management completely realize their full responsibility that it is more important to enforce good safety than it is to negotiate a 5 or 10c raise in wages, then President Truman's industrial safety goals will be reached. Mr. Kumpel said that labor doesn't like federal or state interference any better than management does, but labor depends upon government for enforcement of safety regulations.

DUNLOP TIRE AND RUBBER CO. ELECTS TWO NEW VICE-PRESIDENTS

Howard E. Elden

John H. Swalm

Howard E. Elden and John H. Swalm have been elected vice-presidents of the Dunlop Tire & Rubber Corp., Buffalo, N. Y. Mr. Elden, formerly technical director, has been named vice-president in charge of research and development. Mr. Swalm, formerly production superintendent, has been named vice-president in charge of manufacturing of Dunlop Tire & Rubber.

Hood Rubber Combat Boots

Hood Rubber Co., Watertown, Mass., a division of the B. F. Goodrich Co., has developed a new insulated rubber combat boot for the Armed Forces. Operating on the "thermos bottle" principle, the boots will protect against frostbite even at 45° below. Developed in conjunction with the Naval Clothing Depot at Brooklyn, N. Y., the new boot consists of two layers of rubber with two plies of 19-ounce knitted wool insulation between. The boot is designed to be worn with just one pair of socks. The innermost layer of rubber is faced with nylon film to prevent friction on the inside of the boot. Effective insulation is created by the air trapped in thousands of tiny spaces within the knitted lining. This is said to serve as a barrier to transmission of outside cold and maintain body heat inside the boot. A one-half inch layer of wool felt insulates the bottom of the boot. The new boots have already been shipped to troops in Korea as a replacement for the shoe-pac.

To Manufacture Fiber Glass

According to a recent announcement, the Pittsburgh Plate Glass Co., Pittsburgh, Penna., will soon enter the fiber glass production field. Formation of a separate development and production unit to be known as the Fiber Glass Division is now in progress. Two types of fiber glass, strand fiber and super-fine fiber, will be manufactured under a licensing agreement with the Owens-Corning Fiberglas Corp. The new division will be headed by J. Hervey Sherts who will serve as general manager. Mr. Sherts has been associated with Pittsburgh Plate Glass since 1928 and has been director of the firm's Product Development Department since 1939.

WASHINGTON RUBBER GROUP INSTALLS 1951-52 OFFICERS

The installation of its newly-elected officers and a talk by Brigadier General William M. Creasy featured the Fourth Annual Dinner of the Washington Rubber Group held on October 23 in the Terrace Room at the Washington National Airport in Washington, D. C. Approximately 400 members and guests attended the dinner, including some 50 from the NPA Rubber Division. The dinner was preceded by a social hour.

John T. Cox, Jr., consulting chemical engineer, served as toastmaster at the dinner, being introduced by Gerald Reinsmith, group program chairman. Dr. Cox first introduced Warren Stubblebine (Quartermaster Corps), the retiring group president, who expressed his appreciation for the cooperation rendered to him by group personnel during his tenure of office. He next introduced Seward Byam (DuPont), vice-chairman of the Rubber Division, who brought greetings to the group from the Division.

At this point, embossed gavels, made of hard rubber by the Gates Rubber Co., were presented to the past three presidents of the group, namely, T. A. Werkenthin (Bureau of Ships), Roy Devereaux (Goodrich), and Dr. Stubblebine. It was announced that as of October 23 paid membership in the group had reached 373.

Dr. Cox then administered the oath of office to T. R. Scanlan (Gates Rubber), the newly-elected president of the group who, after expressing his appreciation for the honor, introduced his fellow officers including: Norman Bekkedahl (Bureau of Standards), vice-president; Gerald Reinsmith (Army Ordnance), secretary; Philip Mitten (Army Engineers), treasurer, and Ethel Levene (Bureau of Ships), recording secretary. Committee chairmen for the forthcoming year were also introduced, as follows: *Membership*, T. A. Werkenthin (Bureau of Ships); *Program*, Richard A. Harmon (Connecticut Hard Rubber); *Publicity*, Rachel Fanning (Bureau of Standards).

The speaker of the evening, General Creasy, was then introduced by Dr. Cox. The General, who is Chief of the Chemical Corps, Research and Engineer Division, Army Chemical Center, Maryland, spoke on "Potentialities of Biological Warfare." In opening his talk, he stressed the point that "biological warfare is a form of warfare which nature has waged against man for thousands of years" and said that the new twists are "novel methods of achieving deliberate dissemination of pathogenic microorganisms."

General Creasy reviewed the various means by which saboteurs can introduce biological warfare in this country, among these being the contamination of our water and foodstuffs supplies with live bacteria. He stated that our best method of defense lies in alert public health services which can detect infection promptly and take the necessary measures to localize outbreaks. He warned that the greatest danger of biological warfare is the possibility of panic or if we fail "to insure that we are ahead of any other nation in knowledge and preparedness in this field."

Sid Richardson Names Pearcy

Evert Pearcy

Evert Pearcy, formerly associated with the Ferro Enamel Corp. as a sales engineer, has joined the Sales Department of the Sid Richardson Carbon Co., Fort Worth, Texas. He will make his headquarters at the general sales offices of the company in Akron, Ohio. Mr. Pearcy was graduated from West Virginia University in 1941 with a B. S. degree in chemical engineering. He served in the United States Army for four years, earning the rank of major. After separation from service he joined Ferro Enamel. During the six years of this association, he sold and supervised the installation of their units in this country and abroad.

Rubber Impregnated Packings

A new kind of rubber-impregnated leather packing has been announced by E. F. Houghton & Co., Philadelphia, Penna. The company claims that this product offers definite advantages over either synthetic rubber or wax-impregnated leather, for it has both lower friction and more strength than leather, plus effective sealing, resilience and the heat resistivity of rubber. The leather is completely impregnated with a selected synthetic elastomer. The bond between the leather and the rubber is completed by a special polymerization process. The company states that this is a complete impregnation, not merely a surface treatment. The result is said to be excellent pliability which leads to easier application. The packings are said to offer increased sealing ability, high resistance to oils and solvents, resistance to heat as high as 200° F., resistance to plastic flow, low friction characteristics, high abrasion resistance, and long life.

Issue A.S.T.M. Year Book

The American Society for Testing Materials, 1916 Race St., Philadelphia 3, Penna., has issued a new edition of its A.S.T.M. Year Book. Dated September, 1951, the book includes a complete list of members, both alphabetically and geographically, technical committees, and miscellaneous information and data on society activities. Copies have been supplied to all members.

TRAFFIC CONGESTION AFFECTING SECURITY SAY RUBBER EXECUTIVES

Similarly worded but separate statements attacking the failure of highway construction to keep pace with traffic volume were recently issued by Paul W. Litchfield, chairman of the board of the Goodyear Tire & Rubber Co., and Harvey S. Firestone, Jr., chairman of the Firestone Tire & Rubber Co. In another of his series of "Notes on America's Rubber Industry", Mr. Litchfield stated that our present highway system cannot carry the load thrown upon it today, much less take on the additional load which economic progress will bring. This situation is growing so ominous, he pointed out, that it is threatening our mobility, the key to the closely knit pattern of American living.

The Goodyear chairman charged that traffic congestion is costing the motoring public at least $1,000,000,000 a year in extra operating costs, aside from the mounting toll of accidents and property damage. He called for the immediate construction of a national highway system, designed for modern loads and speeds.

Mr. Litchfield's sentiments were seconded by Mr. Firestone in a recent radio and television talk in which he stated that further delay in the construction of adequate and modern highways may cost the American people thousands of lives and billions of dollars. Mr. Firestone pointed out that little has been done to expand our highway system in the past quarter century to keep pace with the growth in traffic volume. During this period, he said, the number of cars, trucks and buses has increased from 20,000,000 to 52,000,000.

Mr. Firestone stated it will cost $40,000,000,000 to $60,000,000,000 over the next ten years to build essential roads, modernize existing highways and maintain the present highway system in a satisfactory fashion. He noted that highway accidents last year took 35,000 lives, exceeding the death total in Korea.

Goodrich Cable-Splicing Method

A new method of splicing steel cable conveyor belting, developed and patented by the B. F. Goodrich Co., places all cables under equal tension during vulcanization so that each cable carries its share of the load in the finished splice. The new method also permits the straightest possible splice, resulting in belts that track straight and true for economical, trouble-free operation. To make the splice, cable ends are cut in staggered pattern. Small tubular connectors are placed over the butted ends. Connectors are first given a light crimping. The partially made splice is then stressed to even lengths of the cables, and connectors are given a final crimping to lock them in the cables. Rubber and fabric removed for the splice is then rebuilt around the cables. The splice is cured under tension with a conventional vulcanizer. The tensioned splice can be made in the field as well as at the factory. Only special tools needed are a crimping device for squeezing the connectors to anchor the cable ends, and a special scraping tool to remove rubber from the cables.

BOSTON GROUP FALL MEETING HEARS RADCLIFFE AND BUECKEN

The Fall Meeting of the Boston Rubber Group, held on October 19 at the Somerset Hotel in Boston, Mass., featured the presentation of two papers. R. R. Radcliffe, of the Rubber Chemicals Division, E. I. du Pont de Nemours & Co., Inc., spoke on "An Improved Neoprene—Type WRT," while Hans E. Buecken, manager of the Plastic Machinery Division of the National Rubber Machinery Co., spoke on "Recent Developments in Extrusion."

In his address, Mr. Radcliffe noted that Neoprene Type W, the first of a new class of chloroprene polymers, was first introduced in 1949. Although this polymer has many advantages over previous neoprene with respect to stability, processability and compounding latitude, it crystallizes when exposed to moderately low temperatures, he said.

Neoprene Type RT resists crystallization, but it is not as good as Neoprene Type W with respect to stability, processability and certain vulcanizate properties. Accordingly, a Neoprene Type W polymer possessing crystallization resistance has been needed. The development of Neoprene Type WRT fills this need.

Neoprene Type WRT is a modification of Neoprene Type W which closely resembles it in response to vulcanizing agents and accelerators and in vulcanizate properties. In addition, it resembles Neoprene Type RT in resistance to crystallization both in the uncured and cured states. These advantages have been attained without sacrificing any of the well-known properties of the general purpose neoprenes, such as resistance to oxidation, to weathering, to swelling in oil and flame resistance.

Neoprene Type W vulcanizates have outstanding resistance to compression set in the range of 24 to 150° C., but due to crystallization they take high permanent sets when compressed at temperatures such as —20° or 0° C. Neoprene Type WRT not only has excellent resistance to compression set in the range of 24 to 150° C., but it is comparable to the best available elastomers in the range of —40 to 24° C., Mr. Radcliffe concluded.

Developments in Extrusion

Mr. Buecken, in his paper on "Recent Developments in Extrusion," stated that in order to fill the need for a compounder-extruder with provisions to devolatilize for the plastics industry, the National Rubber Machinery Co. has developed a new line of equipment called Single Screw Type Two-Stage Extruders.

The NRM two-stage extruder is a single screw type extruder incorporating two cylinder sections in line. The rear section includes the water cooled feed opening while the front cylinder section includes the devolatilizing chamber. Between the rear and front cylinder section is the torpedo type valving arrangement which is just prior to the devolatilizing section and which can be adjusted by axial movement of the screw, thus making it possible to control the flow of material between the two cylinder sections. The single screw consists of two flighted sections separated by the valve type torpedo.

Another unique and recent NRM development, said Mr. Buecken, is the flared head strainer feed screw used in conjunction with the standard pneumatically operated quick opening flared strainer head. Still another recent and perhaps more important development in rubber reclaim processing is the "Mil-Strainer." The prime purpose of this unit is to not only strain a reverted rubber compound processed by a digester and a Banbury, but also to considerably mix and work the compound, possibly eliminating in some instances the Banbury operation or at least either reducing the number of roughing refiners or increasing their capacity.

Just as important as the "Mil-Strainer" is the "Mil-X-Truder," also recently developed by NRM. The design of this latter unit is principally the same as the "Mil-Strainer" except that the flared strainer head is replaced with a standard die adapter head, therefore omitting also the necessity of the flared head of the screw. The "Mil-X-Truder" makes it possible to extrude cold stored stock, fed at room temperature, at conventionally desired extrusion temperatures of approximately 190° to 200° F.

Reprints of Mr. Buecken's paper, when completed, may be obtained from NRM at Akron 8, Ohio.

COLUMBIA-SOUTHERN ANNOUNCES SALES ORGANIZATION APPOINTMENTS

H. W. Gleichert

E. W. Haley

A. W. Reynolds

Several important appointments in the sales organization of the Columbia-Southern Chemical Corp. have been announced. H. W. Gleichert has been named assistant to the vice-president of the new sales organization. E. W. Haley, formerly located in New York City, will move to headquarters in Pittsburgh, Penna., as Columbia-Southern director of sales. A. W. Reynolds has been appointed administrative assistant to the vice-president in charge of sales. C. F. Bingham, formerly manager of pigment sales, has been named assistant director of sales. J. F. Dockum, formerly district sales manager at Philadelphia, Penna., has also been appointed assistant director of sales. Both Mr. Bingham and Mr. Dockum will be located at company headquarters in Pittsburgh, Penna. P. A. Fodor, formerly of the Market Research and Development Department at Pittsburgh, has been named to succeed Mr. Dockum in Philadelphia. R. M. Simpson has been named acting manager of pigment sales. E. M. Rollins has been named district sales manager at Dallas, Texas, while C. J. Stroemple has moved from the Technical Service Department of the Barberton, Ohio, plant to the Market Research and Development Department at Pittsburgh. Columbia-Southern, a subsidiary of the Pittsburgh Plate Glass Co., produces chlorine, caustic soda, soda ash and related chemicals.

3M Fluorochemicals Available

A new series of fluorochemicals capable of performing many previously impossible industrial assignments and of making other tough jobs easy is now being manufactured on a semi-commercial scale by the Minnesota Mining & Manufacturing Co., St. Paul, Minn. The firm announced it is using a patented electrochemical process to produce the versatile new compounds known as fluorochemicals in a recently completed plant near Hastings, Minn. These products are all carbon compounds each of which contains a high percentage of fluorine. The fluorochemicals serve as a new group of chemical intermediates for use in the manufacture of other products, giving greater weather resistance, greater heat and chemical stability, unusual optical properties, greater surface activity, increased fire resistance and greater fungus resistance.

Washington to Hear Osberg

Edward V. Osberg, assistant manager, Chemical Division, General Tire & Rubber Co., Akron, Ohio, will be the principal speaker at the next meeting of the Washington Rubber Group. The meeting will be held on Wednesday evening, November 21, in the auditorium of the Potomac Electric Power Co. in Washington, D. C. Mr. Osberg will speak on "Polygen, A New Class of Synthetic Rubbers."

HILL ADDRESSES DETROIT GROUP ON "ARE GASKETS ENGINEERED?"

The October 5th meeting of the Detroit Rubber and Plastics Group, held at the Hotel Detroit-Leland in Detroit, Mich., featured an address by Ralph M. Hill of the Armstrong Cork Co. Mr. Hill spoke on "Are Gaskets Engineered?"

In his address, Mr. Hill noted that the 20,000 to 30,000 equipment manufacturers in the United States create many peculiar problems for the gasket manufacturer. A large gasket company will supply many thousands of different gaskets each year—most of which are made to customers' drawings and almost all of which are used in flanges or machines that are in some way different from other flanges or equipment. Almost all are designed by the equipment manufacturer, usually without consulting the gasket source.

Obviously, the gasket industry must make a wide range of materials but must spread the use of individual compositions over a wide range of applications. This is all right if the design engineer understands the characteristics of each individual material he uses and further avoids the common error of assuming that because two or more materials may meet an accepted industry specification that they will behave in service in the same manner. He must further have a real appreciation of the differences that occur between laboratory tests and field service results and the effects in service of various flange surfaces, flange designs, gasket shapes, temperatures, solvents, etc. The effects of such factors were discussed in detail.

The need for further study of stress relaxation in gasket applications was emphasized. Recent studies show that the standard compression set tests do not always reflect losses in flange pressures. By the use of strain gauges it has been shown that of two compounds the one showing the greater compression set may maintain the higher flange presures.

The speaker also reported on recent developments in beater saturation of fiber gasket materials wherein almost unlimited amounts of saturant can be used.

OTEC Seeks New and Used Tires

Organisation, Transports, Echanges Commerciaux, 1 Rue Lincoln, Paris VIII, France, is seeking to purchase both new and used tires in the United States. The firm is particularly interested in new truck tires in the sizes of 700.20, 900.20 and 1,100.20. It is also interested in new passenger tires in these sizes: 600.16, 650.16, 670.16, 525.15, and 550.15. As for used tires, the French firm is looking for tires suitable for recapping in these sizes: 550.16, 600.16, 650.16, 670.15, 700.15, 700.16, 750.16. Persons or firms interested in supplying either new or used tires to this company are requested to contact the firm at the address above.

An economical new sponge rubber underrug cushioning, called "Spongex Ripple," has been developed by the Sponge Rubber Products Co. of Shelton, Conn.

Coming Events

Nov. 26-Dec. 1. 23rd Exposition of the Chemical Industries, Grand Central Palace, New York, N. Y.

Nov. 27. Rubber and Plastics Div., A.S.M.E., Chalfonte-Haddon Hall, Atlantic City, N. J.

Nov. 29. Fort Wayne Rubber & Plastics Group, Hotel Van Orman, Fort Wayne, Ind.

Dec. 14. Boston Rubber Group, Xmas Party, Somerset Hotel, Boston, Mass.

Dec. 14. Chicago Rubber Group, Xmas Party, Morrison Hotel, Chicago, Ill.

Dec. 14. Detroit Rubber & Plastics Group, Xmas Party, Detroit-Leland Hotel, Detroit, Mich.

Dec. 14. New York Rubber Group, Xmas Party, Henry Hudson Hotel, New York, N. Y.

Dec. 18. Buffalo Rubber Group, Xmas Party.

Dec. 20. Elastomer and Plastics Group, Northeastern Section, A. C. S., Room 6-120, M. I. T., Cambridge, Mass.

Feb. 1, 1952. Akron Rubber Group, Winter Meeting, Mayflower Hotel, Akron, Ohio.

Mar. 3-7, 1952. A.S.T.M., Spring Meeting and Committee Week, Hotel Statler, Cleveland, Ohio.

Apr. 4, 1952. Akron Rubber Group, Spring Meeting, Mayflower Hotel, Akron, Ohio.

Apr. 30-May 1-2, 1952. Rubber Division, A.C.S., Spring Meeting, Netherlands Plaza Hotel, Cincinnati, Ohio.

June 20, 1952. Akron Rubber Group, Summer Outing.

June 23-27, 1952. A.S.T.M. Fiftieth Anniversary Meeting, Hotels Statler and New Yorker, New York, N. Y.

Sept. 14-19, 1952. A.C.S., Annual Meeting, Atlantic City, N. J.

Oct. 29-31, 1952. Division of Rubber Chemistry, A.C.S., Fall Meeting, Hotel Statler, Buffalo, N. Y.

Carbon Black Quotas Announced

The Office of International Trade of the U. S. Department of Commerce has announced an export quota of 32.5 million pounds of furnace black for the fourth quarter of 1951. The new quota is the same set during the third quarter, OIT said. However, the agency will authorize only 7 million pounds of semi-reinforcing (SRF) grade black and 4 million pounds of thermal black for export. OIT said the quota on SRF black is a million pounds higher than during the third quarter because of a "slight easing" in supply. The limitation on thermal black remains the same as in the earlier quarter. Protections on fast extrusion (FEF) black, present in the third quarter, have been discontinued.

BUFFALO RUBBER GROUP HEARS TALK BY STEMPEL ON SYNTHETIC

Approximately 60 members and guests of the Buffalo Rubber Group attended the Fall Meeting held on October 23 at the Westbrook Hotel in Buffalo, N. Y. The technical session was addressed by G. H. Stempel, assistant director of research laboratories for the General Tire & Rubber Co. Mr. Stempel spoke on "The Practical Utilization of High Mooney Viscosity GR-S."

In his address, the speaker discussed the preparations, properties and applications of "Polygen", the new oil-enriched synthetic rubber developed by General Tire. He stated that Polygen will produce tires that cost less and wear longer, since the extenders used in the process are lube extracts which are cheap and plentiful.

Mr. Stempel used slides showing graphs, formulations and cost index to compare Polygen with "cold" GR-S. It was shown that lower amounts of sulfur and expensive accelerators are required by Polygen, than in the case of "cold" GR-S. The physical properties of properly balanced Polygen stocks are equivalent or superior to standard synthetic rubber, he said.

Polygen stocks are in the same range as GR-S in respect to modulus, tensile, elongation and flexing. Although Polygen produces stocks with a lower durometer hardness than GR-S, it has proved to be of definite advantage in tire treads. Tires using Polygen have been subjected to extensive road tests with the result that Polygen has been proven superior to "cold" GR-S in tires insofar as road wear ratings and other physical test data were concerned, he said.

The after dinner speaker was Henry K. Epple, senior engineer of the Irving Airchute Co. Mr. Epple spoke on "The Hitler Regime."

General Reorganizes Sales Units

General Tire & Rubber Co. has expanded and reorganized its truck, tractor and industrial sales departments. Sales of all tires, including airplane tires, and air suspensions for truck-trailers will be coordinated under the newly-created Commercial Sales Division. Karl A. Dalsky, manager of truck tire sales at General Tire for the past 20 years, has been named commercial sales manager of the new division. There will be five distinct marketing activities under the jurisdiction of the new division. Each of the activities is headed by an assistant manager. Paul E. Shobert, associated with General Tire since 1939, has been placed in charge of manufacturers' sales. D. H. Gehring, former Boston branch manager, has been named manager of agricultural sales. J. A. Beckett, recently transferred from the Engineering Division to the Sales Department, has been placed in charge of contractor and construction sales. Robert Moran, in charge of General Tire's industrial tire sales for a number of years, has been given the added responsibility of creating and developing the market for new air suspensions for truck trailers. C. G. Myers has been named to head bus and taxicab tire sales.

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NEW YORK GROUP HEARS PAPERS AND ELECTS 1951-52 OFFICERS

The presentation of two technical papers and the election of officers for the 1951-52 season featured the Fall Meeting of the New York Rubber Group, held on October 26 at the Henry Hudson Hotel in New York City. Approximately 190 members and guests attended the meeting which was followed by dinner and entertainment.

The meeting was opened by Chairman M. K. Buffington (Lea Fabrics), who first read a letter from John Fielding (Armstrong Rubber), 1950-51 chairman of the A.C.S. Rubber Division, congratulating the group on its handling of the recent Division meeting in New York. He then introduced Otto Lang (Vulcan Rubber Products), chairman of the Nominating Committee, who presented the following slate of officers for 1951-52, all of whom were elected by unanimous vote:

Chairman, J. S. Corrigall (R. T. Vanderbilt); *Vice-Chairman*, George N. Vacca (Bell Telephone Laboratories); *Secretary-Treasurer*, P. P. Pinto (RUBBER AGE); *Sergeant-at-Arms*, G. H. Provost (U. S. Rubber). The following were elected as members of the Executive Committee for three-year terms: Joseph Breckley (Titanium Pigment), Arthur J. Lang (H. V. Hardman), A. R. Lewis (Monsanto Chemical), and Frank Malm. The latter is currently acting as a consultant to the rubber and plastics industries.

Talk on Heat History

The first of the two technical papers was given by B. S. Garvey, Jr., Laboratory Director, Sharples Chemicals Inc., Wayne, Penna. Discussing "Heat History and Compounding," Mr. Garvey reported on the relation between heat history, as represented by the time of milling on a hot mill, and the scorch time, cure time, and vulcanization time (defined as cure time minus scorch time) as determined in an investigation of two natural rubber wire insulation compounds.

Mr. Garvey explained that the time of milling on a hot mill was taken as a measure of heat history. Scorch time was measured in three ways: (1) On the Mooney machine, (2) By hot milling to scorch, and (3) From a series of press cures at one minute intervals. Cure time was determined in two ways: (1) On the Mooney machine, and (2) From a series of press cures at one minute intervals. In the latter case, he explained, the cure time selected was that of the first cure to reach a definite modulus and tensile strength.

A large number of batches were mixed and subjected to various times and temperatures of hot milling. The press scorch time was found to be slightly shorter than the Mooney scorch time. With one compound, the mill scorch time was fairly close to the Mooney scorch time, while with the other the mill scorch time was very much longer. By use of graphs it was shown that in the Mooney machine part of the stock is working and part is at rest.

According to the speaker, the time to reach a given technical cure decreases with increasing heat history of the stock. Therefore, variations in heat history of the uncured stock could account for some of the mysterious variations in cure which are encountered in production.

For a given compound, Mr. Garvey said, the vulcanization time is constant within narrow limits, and the variations in cure time are due to the varying amounts of scorch time used up in processing.

In concluding, he stated that a stock can be processed and cured at the same temperature, provided factory processing can be so controlled that the heat history can be maintained constant within narrow limits.

Neoprene in the Paper Industry

"The Use of Neoprene Latex in the Paper Industry," the subject of the second paper, was presented by R. H. Walsh, Rubber Laboratory, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. Mr. Walsh first outlined current practices in the manufacture of paper, and then discussed recent developments in the use of neoprene in such paper.

Stating that the addition of latices to paper in coating and saturating methods was far from new, the speaker stressed the point that the DuPont Rubber Laboratory had pioneered in an entirely new development, namely, the addition of neoprene latex to the pulp before it is made into paper. The result, he stated, is a new family of low-cost specialty papers made directly on the paper machine. He exhibited a flow chart of the entire process, and explained how the neoprene latex was fed into the slurry.

Bridgwater Machine Names Slatter

Albert J. Slatter

Albert J. Slatter has been appointed general manager of the Athens Machine Division of the Bridgwater Machine Co., Akron, Ohio. Mr. Slatter is a widely-known tire design and construction engineer. He was associated with the Dunlop Tire & Rubber Co. for many years, and later served as general manager with the Armstrong Tire & Rubber Co. at Natchez, Miss.

PHILADELPHIA MEETING HEARS DISCOURSE ON TELEPHONE WIRES

A talk on "Rubber-Covered Telephone Wires" by George N. Vacca, of the Bell Telephone Laboratories, Murray Hill, N. J., was the feature of the meeting of the Philadelphia Rubber Group held on November 2 at the Poor Richard Club in Philadelphia, Penna. Approximately 120 members and guests attended the meeting.

In opening his talk, Mr. Vacca explained that in the Bell System rubber and other vulcanizable materials are with few exceptions used only on telephone wires intended for outdoor use. These exceptions include telephone cords and carrier pair cable. He emphasized that his talk would be devoted to a discussion of the more important rubber-covered wires, with special reference to the types of insulations and jackets devised to meet service condition requirements.

The speaker made it clear with some insulations the emphasis is on physical properties, while in others it is on electrical properties. Jackets must be weather resistant and in all cases compounds must be chosen for the longest possible, trouble-free service life.

Mr. Vacca explained that telephone wires for the Bell System are manufactured at the Point Breeze plant of the Western Electric Co. by the recently installed "Room Temperature Compound" process. This process, he said, features the cooling of compounds to room temperature immediately after mixing. Thus, all portions of a compound are at a uniform temperature or constant plasticity as they go into the extruder.

As a result of the working which the compounds receive incidental to being warmed up in the extruders, it has been found possible to shorten appreciably the Banbury mixing cycles.

In concluding his talk, Mr. Vacca mentioned that reduction in the amount of scrap previously experienced as a result of pre-vulcanization associated with hot compound feeding is another advantage of the new process, but more important is the practically complete elimination of diameter variation.

Hold Up Rubber Pay Ruling

At this writing (November 7), the Wage Stabilization Board has not yet made a decision on proposals that would raise the pay of the nation's rubber workers by approximately 13 cents an hour in accordance with agreements recently negotiated with most of the larger manufacturers. Specific agreements under consideration are those entered into by U. S. Rubber, Goodyear, Goodrich and Firestone. The agreements were discussed by the Board on October 25, but no decision was reached. It was emphasized that a finding from the Board could be returned "at any time."

Acadia Synthetic Products Division of the Western Felt Works, Chicago, Ill., has added 1,800 square feet of building space for laboratory facilities. The new area should be ready for occupancy shortly.

NPA Sets Inventory Restrictions

NPA has placed inventory restrictions on a host of packaging materials, chemicals and minerals. NPA inventory actions were taken in two parts: Regulation 1 as amended October 22, and Regulation 1, Interpretations 1, 2 and 3 as amended October 22.

Chemicals subject to practicable minimum working inventory limitations include: diphenylamine; phosphate plasticizers; polyethylene resins; polyvinyl alcohol; polyvinyl chloride and copolymer resins; styrene; tetraethyl thiuram disulfide; and Thiokol polymers.

Textile materials which fall under the new inventory regulations include: cotton duck (Army and numbered in the piece), high-tenacity rayon yarn, and webbing of heavy military types.

Thermoid Acquires Essex Rubber

According to an announcement by Fred E. Schluter, president, the Thermoid Co. has acquired control of the Essex Rubber Co. Both companies are in Trenton, N. J. The announcement indicated that Thermoid's cash outlay will not exceed $500,000, including purchase of the controlling shares as well as liquidation of a substantial part of the indebtedness of Essex Rubber. Thermoid has been guaranteeing Essex purchases for some time. The Essex plant occupies 4 acres and employs approximately 400 in the manufacture of molded goods. It also operates a fairly substantial reclaiming plant. Sales of the company have been running at about $3,000,000 a year. No immediate change in Essex personnel is contemplated.

Ball Brothers Name Waldron

Ball Brothers Co., Muncie, Ind., has announced the appointment of Zach K. Waldron, formerly of the Johnson Rubber Co., Middlefield, Ohio, as sales executive for the new Ball Rubber Products Division. Mr. Waldron will be responsible for establishing several new sales offices in key cities and for staffing his new organization. He will also direct and expand sales so as to broaden both the number of products Ball Brothers will manufacture and to make its production more specialized. During the time Mr. Waldron was associated with Johnson Rubber, he was active in the Rubber Manufacturers Association. He is also a member of the government's price stabilization advisory committee for mechanical rubber goods.

Change to Produce Cold Rubber

The government-owned Port Neches, Texas, plant, operated by the U. S. Rubber Co. for the production of synthetic rubber, will be changed to the production of cold rubber instead of standard GR-S, according to a recent announcement. The conversion will cost between $2,000,000 and $2,500,000, and will result in annual production of 88,000 tons of cold rubber. Completion of the project is scheduled for about the first of the year.

NEW POLYMERS AUTHORIZED BY OFFICE OF RUBBER RESERVE

Listed below are types and properties of new experimental GR-S polymers (including GR-S latices) which have been authorized by the Office of Rubber Reserve, Reconstruction Finance Corporation, since publication of those in our previous issue. Procedures for the distribution and sale of these polymers will be found in our October, 1945, issue. Normally, experimental polymers will be produced only at the request of the consumers and 20 bales (one bale weighs approximately 75 pounds) of the original run will be set aside if possible for distribution to other interested companies for their evaluation. The 20 bales when available will be distributed in quantities of one or two bales upon request to the Sales Division of Rubber Reserve or will be held for six months after the experimental polymer was produced unless otherwise consigned before that time. Subsequent production runs will be made if sufficient requests are received to warrant them.

X No.	*Polymer Description*
X-674 GR-S-SP	Same as X-496-GR-S-SP except stabilized with 1.25% (on the rubber) ELGI.
X-675 GR-S	Similar to GR-S-60 except shortstopped with sodium or potassium dimethyl dithiocarbamate and either sulfur as sodium polysulfide or Polyamine H (or equivalent). Stabilized with 1.25% (on the rubber) Wingstay S and coagulated with salt and acid.
X-676 GR-S	An oil-rubber masterbatch of 100 parts of the base polymer as described in X-628-GR-S and 37.5 parts of Circosol-2XH.
X-677 GR-S	X-580-GR-S masterbatch in which the carbex is dispersed with an Entoleter.
X-678 GR-S	Not issued.
X-679 GR-S	Butadiene/styrene charge ratio 75/25 polymerized at 122°F, activated with Nitrazole CF. Emulsified with sodium rosin acid soap and sodium fatty acid soap. Shortstopped with sodium or potassium dimethyl dithiocarbamate and either sulfur as polysulfide or polyamine. Stabilized with 1.25% (on the rubber) of a standard antioxidant such as PBNA. Mooney viscosity 52 ± 6 ML-4 at 212°F.
X-680 GR-S	A masterbatch of 100 parts X-580 latex and 55 parts Spheron 6; the carbex to be dispersed in the Entoleter.
X-681 GR-S	A masterbatch of 100 parts of X-580 latex and 55 parts of Spheron 6.
X-682 GR-S	A masterbatch of 100 parts of high Mooney X-620-GR-S and 40 parts of Circosol-2XH. Butadiene/styrene charge ratio 71/29 polymerized at 41°F, activated with PMHP or equivalent, emulsified with potassium fatty acid soap. Shortstopped with sodium or potassium dimethyl dithiocarbamate and either sulfur as sodium polysulfide or TEPA. Stabilized with 1.25% (on the rubber) ELGI. Glue-acid coagulation. Mooney viscosity of masterbatch 60 ± 7 ML-4 at 212°F.
X-683 GR-S Latex	Butadiene/styrene charge ratio 70/30 polymerized at 50°F, activated with PMHP or equivalent. Emulsified with Neo-Fat K-242; shortstopped with sodium or potassium dimethyl dithiocarbamate. Total solids 47-49.9%. Mooney viscosity of the contained polymer 140 minimum ML-4 at 212°F.
X-684 GR-S Latex	Same as X-683-GR-S latex except total solids 60-63%.
X-685 GR-S-AC	Same as X-644-GR-S-AC except stabilized with 1.25% (on the rubber) ELGI.

Please Note Changes in the Following Polymer Descriptions

X-580 GR-S X-581 GR-S X-582 GR-S	Shortstopped with sodium or potassium dimethyl dithiocarbamate and either sulfur as polysulfide or polyamine.
X-657 GR-S X-658 GR-S	Reaction temperature corrected to read "54°-57°F".
X-671 GR-S	Mooney viscosity 50 ± 4 ML-4 at 212°F.
X-673 GR-S Latex	Butadiene/styrene charge ratio 70/30 polymerized at 50°F; activated with PMHP or equivalent. Emulsified with potassium oleate; shortstopped with potassium or sodium dimethyl dithiocarbamate. Total solids 47.0-49.9%. Mooney viscosity of the contained polymer 70-100 ML-4 at 212°F.

In the future the oxidant for experimental low temperature polymers using DIP, CHP, PMHP, Diox 7, or mixtures will be described by the expression "PMHP or equivalent".

Named General Factory Manager

Joseph Meek

Joseph Meek, formerly assistant industrial relations director for the Firestone Tire & Rubber Co., has been named factory manager of the Memphis, Tenn., plant of the company. Mr. Meek was graduated from Ohio Wesleyan University in June, 1925, and joined the Cost Department of the Firestone company in Akron the following September. He was transferred to the Time Study Department in 1926, and in 1928 was sent to Los Angeles, Calif., to establish the Industrial Relations Department at the newly-established Firestone subsidiary plant in that city. He remained at the Los Angeles plant until 1942, during which time he served as personnel and production manager. Mr. Meek was transferred to the Nebraska Defense Corporation, a bomb loading plant operated by Firestone in Fremont, Nebr., in January, 1942. In 1943 he was named general manager of the plant. In 1944, Mr. Meek was granted a leave of absence to serve with the War Department as deputy field director of ammunition plants for U. S. Army Ordnance. Mr. Meek returned to Akron in September, 1945, as assistant director of industrial relations, a position he held until his most recent appointment.

Expands Koylon Foam Production

U. S. Rubber Co. has greatly expanded its Koylon foam rubber production by setting up an eastern plant for the manufacture of Koylon foam mattresses and cushioning. The eastern plant, located at Woonsocket, R. I., is now producing several hundred mattresses a day and sizeable quantities of cushioning for domestic furniture and institutional use. The eastern foam manufacturing unit was set up to lower shipping costs and speed up delivery throughout the east. Foam production in the Woonsocket plant will enable U. S. Rubber to give immediate delivery on Koylon mattresses, foundations and cushioning. Previously, all Koylon foam was produced by the company at its plant in Mishawaka, Ind.

Seamless Rubber Co. has moved its sales offices to 464 Congress Avenue, New Haven, Conn.

Goodyear Forms Japanese Outlet

Tires and other products of the Goodyear Tire & Rubber Co. are to be manufactured and sold in Japan under the direction of a Japanese-Goodyear sales company recently organized by Goodyear in Tokyo. Officers of the Far Eastern operation, to be known as Goodyear Japan, Ltd., include R. W. Hadley, managing director, and H. B. Puckett, secretary-treasurer. Mr. Hadley was formerly manager of Goodyear's Far Eastern division, while Mr. Puckett was manager of factory accounting at the Goodyear plant in Brazil. Although main offices of the new company are in Tokyo, production operations will be at Kurume, Japan, carried on under contract with the Bridgestone Tire Co., a Japanese concern, and the largest producer of tires in the Orient. All tires and other products manufactured for Goodyear at Kurume will be according to the company's specifications and will bear the Goodyear brand name. Goodyear's production manager at Kurume is J. J. Hartz, formerly manager of product development compounding for the company in Akron. Manufacturing operations are to get under way as soon as equipment can be readied and personnel trained, company officials said.

American Biltrite Expansion

A plant modernization and expansion program costing approximately $750,000 is nearing completion at the Rubber-Flooring Division of the American Biltrite Rubber Co. in Trenton, N. J. The plant expansion includes installation of a straight-line production set-up as well as a new office and finished tile building. What is said to be the first straight-line production set-up in the rubber tile industry has been completed and is now in operation. This new equipment has already resulted in expansion of production by 25%, company officials said, and will permit the company's output to be increased another 10%. The two-story combination office and tile finishing building, now under construction adjacent to the present Trenton plant, will be ready for occupancy by the end of 1951. Modern offices will occupy the entire second floor of the structure.

VINYL SPECIALTIES

National Mask & Puppet Corp., Brooklyn, N. Y., has introduced a new line of marionettes with heads made of Vinylite resin. The life-like heads are molded in the likeness of famous characters from the movies, television and comic strips.

Smartly designed by Lilly Dache, new ladies' billfolds manufactured by Aristocrat Leather Products, Inc., New York, N. Y., are made of embossed Vinylite plastic film in polka dot patterns.

Items made of Vinylite film can now have colorful pictures transferred to them by a new process which employs inks based on Vinylite resins. The inks are made by the Warwick Chemical Co. and are used in decals produced by Palm, Fechteler Co., New York, N. Y.

Hamilton Named Vice-President

John M. Hamilton

John M. Hamilton, associated with the Binney & Smith Co. since 1933, has been elected a vice-president of the company. A graduate of Yale University, Mr. Hamilton served as a salesman from 1933 until 1939 at which time he was made assistant sales manager and advertising manager. This assignment was interrupted during World War II by some three years service with the United States Navy. On leaving the Navy in 1945, Mr. Hamilton had attained the rank of Lieutenant Commander. Rejoining Binney & Smith he continued in the position he last held until 1946 when he assumed the duties and titles of assistant to the president and sales manager of the Carbon Black Division. In 1950, Mr. Hamilton became a director of the company and manager of pigment sales. He will combine these assignments with his new duties as vice-president.

Power Curve Rice Field Tire

B. F. Goodrich Co., Akron, Ohio, has introduced a new tire for tractors and combines used in rice farming. Named the "Power Curve" rice field tire, the new casing is said to be the first tire suitable for use in all types of soil used for growing rice. Open center tread and slanted-nose cleats feature the new high flotation tire. The cleat action resists bogging down and makes for maximum drawbar pull. As cleats release from the earth, the slanted nose helps clean the tread since these angled surfaces provide no niches for mud and straw to cling to. Each cleat is extra high at the shoulder to bite deeper and is braced by its curve to stand rigid. The tread is symmetrically designed for smooth riding when equipment travels over road surfaces.

Dayton Rubber Arranges Loan

Dayton Rubber Co., Dayton, Ohio, has completed arrangements with nine banks for a $6,000,000 credit. The interest rate on the loan, the banks involved, and the use of the proceeds were not disclosed. The credit, replacing one in the amount of $4,000,000, is scheduled to run for three years.

ADDITIONAL TECHNICAL PUBLICATIONS OF BRPRA MADE AVAILABLE

Abstracts of some of the recent publications issued by the British Rubber Producers' Research Association are published from time-to-time in RUBBER AGE. These booklets, which cover research work conducted by various members of the BRPRA staff, may be secured by writing the Association at 19 Fenchurch Street, London E.C. 3, England. Abstracts of some of the more recent publications follow:

Mastication and Compounding of Natural Rubber in an Oxygen-Free Atmosphere, by C. M. Blow and R. I. Wood. (Publication No. 134): Confirmation has been obtained that raw rubber when masticated in the absence of oxygen undergoes only a limited amount of breakdown; and it has been shown that two of the better known so-called "peptizers" or chemical plasticizers of rubber, viz., mercaptobenzothiazole and α-α'-dibenzoamidodiphenyl disulfide, require oxygen to be effective. A range of pure gum rubbers has been compounded under nitrogen, and the physical properties after vulcanization compared with corresponding air-compounded rubbers. Some types of acceleration give vulcanizates whose physical properties are very sensitive to changes in the viscosity of the unvulcanized stock, decrease in viscosity giving decreased modulus. Other types of acceleration, notably "boosted" combinations which give high modulus vulcanization, are insensitive to stock viscosity changes over a wide range.

Latex Moulding by Plaster Casting, by S. C. Stokes. (Publication No. 135): Methods for producing cast figures from latex concern mainly, first, the use of porous molds and secondly, the use of metal molds with heat-sensitized latex. Particular reference is made to the production of hard figures for display purposes in which a plaster mold is filled with compounded latex. When a deposit has formed on the mold surface, the excess latex is removed and the deposit is dried sufficiently to allow removal of the mold. The figure is then dried and vulcanized in hot air. Mention is also made of soft figure production, and the use of rubber molds for casting plaster figures.

The Nature of the Sulphur-Oxygen Bond, by W. Moffitt. (Publication No. 136): The electronic structures of certain molecules containing oxy-sulfur bonds are analyzed in some detail by means of the molecular orbital method. It is possible to make rough calculations which, despite the complexity of the systems considered, are nevertheless reasonably reliable. The physical and chemical properties of sulfur dioxide, sulfur trioxide and molecules of the types R_2SO_2 and R_2SO are discussed on the basis of these structures. In all these molecules it appears that the oxy-sulfur linkages are best described as double-bonded. A successful correlation between the molecular orbital criterion of bond strengths, namely, the bond orders, and the oxy-sulfur bond force constants may be set up. The measure of agreement attained between observed and predicted properties is quite satisfactory.

Some Problems Involved in the Grading and Testing of Natural Rubber: A Progress Report, by W. P. Fletcher. (Publication No. 137): The justified demand of the manufacturing user of natural rubber for a material of better quality has become more insistent during the years since the resumption of large-scale plantation production in the areas formerly in Japanese occupation. The present work is part of a program intended to lead directly to a satisfaction of that demand. The term "quality" used of raw rubber in its solid form may include the following properties: (1) Cleanness; (2) Processibility of unvulcanized materials; (3) Properties of vulcanizates prepared from the rubber. Work is proceeding in all three fields; the present paper is mainly concerned with properties of vulcanizates.

Kinetic Studies in the Chemistry of Rubber and Related Materials: VIII. Influence of Chemical Structure on the α-Methylenic Reactivity of Olefins, by J. L. Bolland. (Publication No. 138): The efficiency of the radical reaction

$$RO_2 - + RH \rightarrow RO_2H + R -$$

(representing the exchange of a hydrogen atom between an α-group of an olefin RH and a peroxide radical RO_2-) has been determined for the members of a series of twenty-four unsaturated hydrocarbons. The influence of certain structural features of olefinic groupings in determining the case of α-methylenic hydrocarbon abstraction (and hence on the dissociation energy of αβ carbon-hydrogen bonds) have been identified: thus in the olefinic system

$$\underset{(a)}{CH_3} - \underset{(b)}{CH} = \underset{(c)}{CH_2}$$

the α-methylenic reactivity of the group (a) (as measured by the above exchange reaction) is unaffected by alkyl substitution at (b), but is increased by alkyl substitution at (a) and (c) (at 45°C. by a factor of 3.3^n, where n is the total number of substituents introduced).

Term Values in Hybrid States: Aspects of Hybridization, by W. Moffit. (Publication No. 139): In this paper a number of calculations are undertaken, which are considered necessary to a proper understanding of the factors governing orbital hybridization. A convenient classification of the different types of hybridization which arise for elements of the first short period is introduced. A general method is then developed for the calculation of the term values of the hybrid valence states associated with such atoms. This method is followed numerically for carbon, nitrogen and oxygen, which are particularly interesting in chemistry.

An Analysis of the Isomeric Composition of Bromodihydromyrcene: Dehydrobromination Experiments with Bromodihydromyrcene, by L. Bateman, J. I. Cunneen and H. P. Koch. (Publication No. 140): (1) The possible isomeric complexity of the products obtained when olefins undergo substitutive reactions at carbon atoms adjacent to the double bond is strikingly exemplified by the allylic bromide produced by reacting dihydromyrcene with N-bromosuccinimide. Largely by means of infrared spectroscopy, the isomeric composition of this bromide has been approximately analyzed, and is found to conform to certain theoretical predictions. (2) The elimination of hydrogen bromide from the heterogeneous dihydromyrcene bromide gives only small yields of the conjugated triene, *allo*-ocimene. The major products consist of open-chain trienes containing conjugated diene units and cyclic conjugated dienes. Possible mechanisms responsible for this rather surprising finding are discussed.

Volume Changes in the Stretching of Vulcanized Natural Rubber, by Geoffrey Gee, Jan Stern and L. R. G. Treloar. (Publication No. 144): Measurements are presented of the volume changes accompanying small (>100%) elongations of vulcanized natural rubber completely free from undissolved particles. The small expansions found agree with those calculated from the known compressibility of the rubber and the hydrostatic component of the stretching force. It is pointed out that this volume change mechanism applies generally to any isotropic body, and does not contribute significantly (in rubber) to the tensile stress.

Conjugation in Sulphones, by H. P. Koch and W. E. Moffitt. (Publication No. 145): The possibilities of conjugation in unsaturated or aromatic sulfones have been investigated on the basis of molecular orbital theory. It is found that different kinds and degrees of conjugation arise in differently substituted compounds, depending on the number (one or two) and steric arrangement of the unsaturated groups attached to the sulfur atom. Strong conjugation is predicted for thiophene-1-dioxides and related structures, and rather weaker donor-acceptor type conjugation not affecting the oxy-sulfur bonds for diphenyl sulfones. These and other similar conclusions are in excellent agreement with and reconcile the hitherto seemingly rather contradictory chemical and spectroscopic evidence on sulfone conjugation.

NAMES IN THE NEWS

LOREN A. MURPHY, divisional manager of the Purchasing Department of the Goodyear Tire & Rubber Co. since 1947, has been appointed assistant to the vice-president and general manager of the Goodyear Aircraft Corp.

SAMUEL KAHN, formerly associated with Godfrey L. Cabot, Inc., has joined the technical staff of the research laboratory of the Witco Chemical Co. at Chicago, Ill.

BERNARD V. LUDWIG, formerly an adhesives salesman in the Chicago office of the Dewey & Almy Chemical Co., has been promoted to sales manager of the Adhesives and Coatings Division of the company.

FRED D. STINAFF, associated with the B. F. Goodrich Co. since 1925, has been named manager of engineering equipment purchasing for the company succeeding E. G. HAMMACK, who was recently appointed manager of metal parts purchasing.

DR. JOSEPH R. STEVENS, previously technical director of the J. T. Baker Chemical Co., has been elected a vice-president of the company.

L. R. ERVIN, most recently associated with the National Production Authority as consultant on mechanical rubber goods, has been named manager of the Cleveland, Ohio, branch office of the Ohio Rubber Co.

SAMUEL W. SOMERVILLE, associated with the B. F. Goodrich Co. for the past 15 years, has been named manager of the Time Study and Methods Department of the company.

HARVEY S. FIRESTONE, JR., chairman of the board of the Firestone Tire & Rubber Co., has been awarded the Philander Chase Medal of Kenyon College for devoted and distinguished service to the Protestant Episcopal Church.

J. JERRY TAYLOR, associated with the B. F. Goodrich Co. for the past 12 years, has been named manager of the Track Departments of the Tire Division of the company. DELBERT L. CRONE has been named production manager of the Track Departments reporting to Mr. Taylor.

HAROLD R. WILLIAMS, after five years as Washington, D. C., representative for the B. F. Goodrich Chemical Co., has been named Washington district manager of industrial products sales for the B. F. Goodrich Co.

HAROLD E. WIRTH, associated with the Firestone Tire & Rubber Co. for many years, has been named manager of its Washington Defense Products Division and Government Sales Office in Washington, D. C.

FRANK E. MAPLE, associated with the Commercial Solvents Corp. since 1936, has been appointed assistant general manager of the Industrial Chemicals Division of the company.

JAMES G. BARBOUR, associated with the Chicago Rawhide Manufacturing Co. for many years, has been named a vice-president and a member of the Management Council of the company succeeding the late HERMAN M. KOELLIKER. In his new capacity, Mr. Barbour will be in charge of all synthetic rubber activities of the Sirvene Division of the company.

LELAND ONEACRE, formerly associated with Firestone and with the Fremont Rubber Co., has been named technical director of the Cooper Tire & Rubber Co., Findlay, Ohio.

ALFRED H. DREWES, previously assistant to the president of the National Lead Co., has been named a vice-president of the company.

DR. H. A. WINKELMANN, research director of the Dryden Rubber Division, Sheller Manufacturing Corp., has been elected chairman of the SAE-ASTM Technical Committee on Automotive Rubber.

PAUL E. LAVALLEY, formerly technical director of the Charles Howe Corp., and JOSEPH GREEN, a recent graduate of the University of Kansas with a master's degree in chemistry, have joined the research staff of the U. S. Rubber Reclaiming Co. at Buffalo, N. Y.

PROFESSOR EDWARD R. SCHWARZ, head of the Textile Division, Massachusetts Institute of Technology, received the Harold DeWitt Smith, Memorial Medal on October 16, at the Fall Meeting of ASTM Committee D-13 on Textile Materials held in New York City.

P. W. LITCHFIELD, chairman of the board of the Goodyear Tire & Rubber Co., has been presented with a distinguished service citation from the Automobile Old Timers' Club for his "outstanding contributions to progress in transportation and signal advancements in the field of industrial relations within the rubber industry."

JACK H. DOLLINGER, formerly assistant sales manager and technical assistant to the executive vice-president of Glyco Products Co., Inc., Brooklyn, N. Y., has been named sales manager of the company.

T. F. SHAFFER, associated with the Shell Oil Co. for the past 14 years, has been appointed manager of the Special Products Department of the company succeeding R. T. GOODWIN, who recently retired.

DR. JOSEPH R. STEVENS, previously technical director of the J. T. Baker Chemical Co., Phillipsburg, N. J., has been elected a vice-president of the company.

T. E. PITTENGER, factory manager of Plants 1 and 2 of the Firestone Tire & Rubber Co. in Akron, Ohio, was recently honored upon the completion of 35 years' service with the company.

FRANK T. MAGENNIS, vice-president of the Goodyear Tire and Rubber Export Co., has been elected chairman of the board of directors of the International Road Federation, American Region.

G. H. SWART, research director of the General Tire & Rubber Co., attended the German Chemical Conference at Neuenahr on October 11, 12 and 13 as part of an extensive tour of Europe he recently made.

FRANK D. HENDRICKSON, president of the American Hard Rubber Co., has been named chairman of the Rubber Division of the 1951 Travelers Aid Society Campaign.

ARNOLD KNEITEL, formerly silicone sales representative in the New York area for the Chemical Division of the General Electric Co., has been transferred to the company's silicone plant at Waterford, N. Y., as a member of the headquarters' sales organization.

F. W. KUHLKE, manager of the New York office of the Firestone International Co., recently observed his 25th anniversary of service with the Firestone Tire & Rubber Co.

GEORGE H. BRUNT, for the past 20 years associated with the Flintkote Co., New York, N. Y., has been named general manager of the Southern Latex Corp., Austell, Ga.

GEORGE M. MCTAVISH, associated with the U. S. Rubber Co. for some time, has been named manager of the Government Department of the Tire Division of the company succeeding LAWLER B. REEVES, recently promoted to the position of sales manager, U. S. Tires.

HENRI M. MARC, formerly vice-president of the American Pad & Textile Co., Greenfield, Ohio, has been elected president of the company.

R. B. MACKENZIE, formerly a sales engineer for the Parker Appliance Co., Cleveland, Ohio, has been appointed assistant sales manager of the company.

MALVERN J. HILER, previously executive vice-president of the Commonwealth Engineering Co. of Dayton, Ohio, has been appointed president of the company.

GEORGE W. POLAND, JR., formerly assistant sales manager for the Stauffer Chemical Co., has been named vice-president of the E. M. Sergeant Pulp and Chemical Co., Inc., New York, N. Y., and president of its New Jersey subsidiary, Sergeant Chemical Co. of Newark.

More Certificates of Necessity

The Defense Production Administration has issued a number of additional Certificates of Necessity providing for accelerated tax amortization on new defense facilities. Certificates listed below without a dollar value are those in which a portion of the facilities involved in the application was completed or acquired prior to September 23, 1950. In these cases, DPA action is taken in accord with provisions of the Act and action will be taken later on the remainder of the facilities involved. Certificates issued recently include:

U. S. Rubber Co., Naugatuck, Conn., allowed 75% of the amount for which it had applied for the construction of fuel cells.

Monsanto Chemical Co., Springfield, Mass., allowed 60% for polyvinyl chloride resin.

E. I. du Pont de Nemours & Co., Inc., Niagara Falls, N. Y., allowed 50% for polyvinyl alcohol.

Pantasote Co., Passaic, N. J., allowed 60% for vinyl sheeting.

Union Carbide & Carbon Corp., South Charlestown, West Va., allowed 70% for polyethylene plastic, and 60% for vinyl chloride resins.

Reynolds Metal Co., Gary, Ind., allowed 60% for polyvinyl chloride film.

Dow Chemical Co., Freeport, Texas, allowed 50% for butadiene-styrene latex.

Monsanto Chemical Co., Long Beach, Calif., allowed 60%, or $468,113, for styrene polymer.

France to Produce Synthetic

Plans are rapidly taking shape for the production of synthetic rubber in France. These plans are in the hands of the Société d'Etudes du Caoutchouc Synthétique à la Base d'Alcool, an organization recently established by various alcohol, petroleum and chemical interests to determine which process shall be established. The choice has narrowed down to either alcohol or petroleum for butadiene production and a decision is expected shortly. The plans call for the production of 40,000 tons of butadiene-styrene rubber as well as 10,000 to 12,000 tons of butyl-type rubber. The total amount of synthetic rubber planned would meet 40% of new rubber requirements of the country annually. Although no decision has been reached as to who will produce the synthetic, it is known that the Society, despite limited capitalization, expects to be one of the producing concerns.

Named Ross and Rowe President

W. F. Schlesinger, sales manager of Ross & Rowe, Inc., New York, N. Y., since 1932, has been named president of the company succeeding J. Edward Rowe, who has become chairman of the board. In other changes, W. K. Hilty, formerly technical director of the company, was named a vice-president. The promotions were announced at the 25th Anniversary celebration of the company held at the Hotel Biltmore in New York City on October 13.

WASHINGTON APPOINTMENTS

William C. Truppner, formerly deputy assistant administrator for production controls of the National Production Authority, has been named acting administrator for production controls.

Osgood V. Tracy, on leave as general manager of the Chemical Products Department of the Esso Standard Oil Co., has been named deputy director of the Chemical Division of the National Production Authority.

Gabriel J. Ticoulat, previously deputy assistant administrator of the Chemical, Rubber and Forest Products Bureau of the National Production Authority, has been appointed deputy administrator for international problems for the Defense Production Administration.

Hold 1951 Hardware Exposition

The 1951 National Hardware Show was held at Grand Central Palace in New York City from October 8 to 11. Four floors were devoted to the usual exhibits which covered the full range of the hardware field. Among rubber manufacturers displaying their wares were Pretty Products, Inc., Plymouth Rubber Co., Inc., W. J. Voit Rubber Corp., Dewey & Almy Chemical Co., Martin Rubber Co., Inc., H. O. Canfield Plumbing Supply Co., Central Rubber Products Co., Sun Rubber Co., J. A. Dubow Sporting Goods Corp., Pennsylvania Rubber Co., Mystik Adhesive Products, L. H. Gilmer Co., Division of U. S. Rubber Co. Among the companies displaying plastic garden hose were the American Extruded Products Co. and the Industrial Synthetics Corp. The Firestone Plastics Co. exhibited its Velon screening, as well as Velon yarn and film.

Dow Chemical Styphen I

Dow Chemical Co., Midland, Mich., has introduced Styphen I, a new and effective antioxidant for both GR-S and natural rubber. Chemically, the product is a tris (a-methylbenzyl) phenol mixture. As a mixture of styrenated phenols, the material has shown outstanding non-staining properties which should make it especially useful in the protection of such rubber articles as white sidewall tires, refrigerator gaskets and electrical wiring insulation. Storageability and protection against surface crusting (resinification) are vastly improved with the addition of 1.25% Styphen I, the company states.

General Tire Adds Subsidiary

General Tire & Rubber Co., Akron, Ohio, has established a new subsidiary, General Tire International Co., to handle foreign transactions outside of the Western Hemisphere. The three incorporators, Frank W. Knowlton, R. W. Shaffer and T. E. Pittenger, Jr., are members of General Tire's Legal Department. The company is authorized to issue 250 shares of stock with a par value of $100.

Borden Plans Resorcin Plant

Plans to construct a $600,000 resorcin manufacturing plant in Dominguez (Los Angeles County), Calif., were recently announced by the Chemical Division of the Borden Co. Authorization to build the plant has been granted by the National Production Authority in view of the critical shortage of resorcin which is hampering production of vital defense materials. Originally, NPA had authorized the company to build the plant in Tacoma, Wash., but this plant was abandoned when a shortage of essential raw materials developed in that area. With the shift of the plant site to Dominguez, Borden acquired a 7½ acre tract from the Stauffer Chemical Co. To be the first resorcin plant on the West Coast, it will produce at least 1,000,000 pounds of technical grade resorcin annually, under the management of Herbert H. Clarke, Jr., a vice-president of the Chemical Division. In addition, it will produce resin glues and industrial resins for the plastic molding and compounding industry in the area. Eventually, Borden will also produce molding compounds at the new plant. The 1,000,000-pound resorcin figure involves the use of 7,000,000 pounds of raw materials, about 90% of which are available in the immediate area. The principal raw materials are benzene, caustic soda and sulfuric acid.

Chicago Group Hears Lockwood

Approximately 215 members and guests of the Chicago Rubber Group attending the meeting held on September 28 at the Morrison Hotel in Chicago, Ill., heard a talk by Warren S. Lockwood, director of the Natural Rubber Bureau, Washington, D. C. Aided by his associate, H. C. Bugbee, Mr. Lockwood spoke on the general political and economic conditions of rubber production in Malaya. They stressed the problems brought on by the Communists in blocking production. Francis Frost, of the Frost Rubber Works, Inc., gave a report on the recent meeting of the American Chemical Society in New York. John L. Strom exhibited moving pictures taken on his trips through the Far East and Russia. Formation of the Fort Wayne Rubber & Plastics Group was announced at the meeting. The Chicago group is acting as official sponsor for the new group.

Aetna-Standard Personnel Changes

Aetna-Standard Engineering Co., Pittsburgh, Penna., has announced several changes in operating personnel. R. D. Johnson, formerly general manager of company plants at Ellwood City, Penna., and Warren, Ohio, has been named assistant to H. G. Coffey, company vice-president. Mr. Johnson has been succeeded as general manager at Ellwood City by T. C. Ben. Lawrence R. Jeffers has taken over as general superintendent of the Ellwood City plant with W. E. Durstine as assistant. James H. Rauch has been appointed superintendent of the Roll Department and Robert R. Kelly has been named office and traffic manager of the Ellwood City plant.

FINANCIAL NEWS

Boston Woven Hose & Rubber Co.

Year Ended August 31: Net income of $1,211,454, which is equal to $13.66 per share on the outstanding common stock, compared with $713,740 or $7.84 per share, in the preceding year. Sales in the fiscal year ended August 31, 1951, amounted to $25,769,105, the highest in the company's history and an increase of 70% over the $15,192,217 in the fiscal year ended August 31, 1950. As of August 31, 1951, total current assets were $9,171,211, while total current liabilities were $3,546,826. At the end of the preceding fiscal year, total current assets were $6,704,153, and total current liabilities were $1,540,318.

American Hard Rubber Co.

Thirty-Six Weeks to September 9: Net income of $649,872, which is equal to $6.45 a common share on net sales of $16,004,571, compared with $476,943, or $4.49 a share on sales of $10,145,966, in the corresponding period of 1950. The statement includes earnings of the Pequanoc Rubber Co., a wholly-owned subsidiary.

National Automotive Fibres, Inc.

First Nine Months: Net profit of $3,421,357, which is equal to $3.43 a capital share, compared with $3,350,562, or $3.36 a share, in the first nine months of the preceding year. Net sales in the first nine months of 1951 totaled $69,233,590, against $53,263,588 in the first nine months of 1950. The report includes the wholly-owned subsidiaries of the company.

Eagle-Picher Company

First Nine Months: Net profit of $2,880,716, which is equal to $3.20 per share, compared with $1,891,866, or $2.12 per share, for the first nine months of 1950. Net sales in the first nine months of 1951 totaled $62,383,220, an increase of 34.6% over sales of $46,331,350 for the same period of the preceding year.

Interchemical Corporation

First Nine Months: Net profit of $1,877,454 which is equal to $2.44 a common share on sales of $66,951,013, compared with $3,394,232, or $4.73 a share on sales of $61,583,921 in the first nine months of 1950. The statement includes earning of subsidiaries.

Allen Industries, Inc.

First Nine Months: Net income of $774,766, which is equal to $1.39 a common share on sales of $25,238,152, compared with $1,204,906, or $2.15 a share on sales of $24,883,545, in the first nine months of 1950.

Diamond Alkali Co.

First Nine Months: Net profit of $5,662,112, or $2.52 each on 2,243,228 shares outstanding, after reflecting the two-for-one stock split effective September 21, 1951, compared with $2,654,833, or $1.18 per share in the first nine months of last year after restating Federal income taxes to the average rate for the year and reflecting the stock split. Net sales in the first nine months of 1951 totaled $60,443,689, against $38,119,722 in the first nine months of the preceding year.

Brunswick-Balke-Collender Co.

First Nine Months: Net profit of $735,496, which is equal to $1.43 a common share on net sales of $18,195,854, compared with $1,853,294, or $3.90 a share on sales of $22,525,866, in the first nine months of the preceding year.

Circle Wire & Cable Corp.

First Nine Months: Net profit of $1,700,243, which is equal to $2.26 a share on sales of $13,494,112. A comparison with the corresponding period of the previous year is not available.

Hewitt-Robins Inc.

First Nine Months: Net income of $770,867, which is equal to $2.77 a share on net sales of $26,254,814, compared with $778,742, or $2.79 a share on sales of $15,709,284, for the same period of 1950.

Rome Cable Corp.

Six Months to September 30: Net profit of $729,549, which is equal to $1.56 a common share, contrasted with $639,798, or $1.50 a share, in the corresponding period of 1950.

O'Sullivan Rubber Corp.

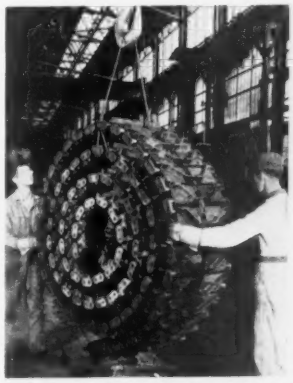
First Nine Months: Net profit of $172,656, which is equal to .38c a share, compared with $136,250, or .28c a share, in the first nine months of the preceding year.

Opens New Iron Blue Plant

Mineral Pigments Corp., Muirkirk, Md., has opened a new iron blue plant. The products to be manufactured at the new plant will be marketed under the name of "Texturized" iron blues. The company states these are the softest and easiest grinding blues ever offered commercially. The company has also announced the appointment of Alan Insley to its New York office.

Firestone Rubber Tank Tracks

Rubber block tank tracks, manufactured by the Firestone Tire & Rubber Co., as shown below, are delivered in coils to the Detroit Arsenal for installation on General Patton M-46 tanks. The rubber-to-rubber contact between track wheels and the tank tracks makes possible higher speeds, greater mobility, longer wear and less maintenance on U. S. Army tanks.



Data on Celogen Blowing Agent

Naugatuck Chemical Division of the U. S. Rubber Co. has made available additional data on its new blowing agent, "Celogen." Suitable for the manufacture of both rubber and plastic sponge products, Celogen is a chemically p,p'-oxybis (benzene sulfonyl hydrazide). It is a white stable powder at normal temperatures but decomposes at temperatures above 135° C. with the liberation of nitrogen gas. Because of its high decomposition point, it can be added to relatively hot stocks on a mill without danger of a premature blow. It can be used with either natural or synthetic rubber, a variety of plastics and the new rubber-plastic blends. Sponge rubber made with the product has a fine, uniform cell structure of either the open pore or closed pore type. The sponge can be non-staining, non-discoloring and odorless. Celogen is particularly suited for the manufacture of vinyl plastic sponge. The resulting vinyl sponge is said to be unusually buoyant, weighs six to eight pounds per cubic foot, is flameproof, and ranges from a rigid to a soft structure. Tests to date indicate it to be non-toxic.

Bureau Celebrates 50th Anniversary

Fifty years of plant science were celebrated at the Plant Industry Station at Beltsville, Md., on October 24 to 26, marking the establishment of the Bureau of Plant Industry in the U. S. Department of Agriculture. The Bureau of Plant Industry was established in 1901 to bring together related lines of research already in progress in the Department of Agriculture. These included studies in the breeding and improvement of major crop plants, and foreign seed and plant introduction and study.

CANADIAN NEWS

American Resinous Chemicals of Canada, Ltd., has been formed at Toronto as a joint venture by the American Resinous Chemicals Corp. of Peabody, Mass., and Roxalin of Canada, Ltd. The new company will manufacture, distribute and sell the American concern's line of highly specialized coating and resin emulsions. Manufacturing for the Canadian market initially will be handled by Roxalin, which makes industrial finishes for preserving and decorating metal, wood, plastics and textiles. The company at present is spending more than $100,000 to expand its production facilities.

A public offering of $1,500,000, 5½ 15-year first mortgage sinking bonds of Gutta Percha & Rubber, Ltd., is being made at $98.50 to yield 5.15% by a group of investment houses in Toronto, Ont. Proceeds will be used to redeem $735,900 first mortgage bonds presently outstanding, to repay $275,000 bank overdraft and for general corporate purposes including plant extensions and equipment for production of a special high-pressure flexible hose.

The present company, formed in 1912 to acquire the business founded in 1883, is the largest independent rubber company in Canada. Net earnings for the six months ended June 30, 1951, totaled $314,873 compared with $331,816 for the full year of 1950. The balance sheet as of June 30, giving effect of current financing, shows current assets of $4,439,986 and current liabilities of $1,254,073.

Henry G. Harper, associated with the Goodyear Tire & Rubber Co. for the past 34 years, has been appointed vice-president in charge of sales for the Goodyear Tire & Rubber Co. of Canada, Ltd. Mr. Harper started with the company as a chief clerk in Charlotte, N. C., immediately after his graduation from the University of North Carolina. He held various sales positions in the Charlotte district until 1928, when he was transferred to Richmond, Va., as a branch manager. He returned to Charlotte in 1934 as branch manager and the next year was appointed manager of the company's advertising department at Akron where he remained until 1937, when he was appointed Western Division manager at Los Angeles. Mr. Harper returned to Akron in 1942 as merchandise manager of the retail stores division, and later in the same year was named manager of associated merchandise, a position he held until his recent appointment.

Lacquer Products Co., Ltd., Granby, Que., has just completed a new building for the manufacture of lacquer finishes for various products. The new building is of the latest design and includes all the new safety features for the handling of nitrocellulose and lacquer solutions. Lacquer Products is a subsidiary of the Stedfast Rubber Co. of Boston, Mass.

Mailman Corp., Montreal, Que., has acquired the manufacturing facilities and assets of Cambridge Rubber, Ltd., Montreal, through purchase of the capital stock. Cambridge Rubber maintained a factory at St. Remi de Napierville, Que. The sale included license arrangements for Canada on certain trade-marks and patents. While other details of the transaction were not made available, it has been indicated that Mailman will change the name of Cambridge Rubber in the near future.

An issue of $2,000,000 General Tire & Rubber Co. of Canada, Ltd., 5% sinking fund debentures, due November 1, 1969, has been placed privately through a syndicate in Toronto. General Tire will use the money for general corporate purposes including repayment of advances made by its parent company.

Stabilized Parlon Available

Hercules Powder Co., Wilmington, Del., has introduced a stabilized grade of chlorinated rubber that is expected to give paint manufacturers a marked improvement in heat and light stability, better weathering and a reduction in under-film rusting. Available at no extra cost, the company's stabilized chlorinated rubber, "Parlon," retains the natural advantages of the original product which has been used for many years as a base for industrial maintenance paints. These paints are especially resistant to all alkalies, acids, fumes and other corrosive elements that attack metal surfaces. The new form of Parlon contains a small amount of an epoxy-type stabilizer that is water insoluble and readily compatible with the resins and solvents normally used in formulating the finished paints. The company states that paints made from the new stabilized product also have better "can stability," minimizing corrosion of the interior of metal containers in which Parlon-base paints are packaged.

National Electric Buys Plant

National Electric Products Co., of Pittsburgh, Penna., has acquired the former Lidgerwood Manufacturing Co. plant at Elizabeth, N. J., from the Standard Tool and Manufacturing Co. of Arlington, N. J., for about $1,000,000. National Electric will start immediately to equip the plant with more than $2,000,000 worth of machinery for the manufacture of electrical "roughing in" materials. The Elizabeth unit will make rigid conduit, electric metallic tubing, switch boxes and other items in the company's line of items for the building trades. Operations are expected to get under way by January 1, 1952. Employment may run into several hundred persons, it was said.

All-Neolite Shoe Introduced

A non-leather shoe, made entirely of Neolite, was recently introduced by the Goodyear Tire & Rubber Co. at the National Shoe Fair in Chicago, Ill. Used extensively for shoe soles and innersoles since 1944, Neolite was recently brought out in sheet form for fabrication by the luggage and leather goods industry. Goodyear officials said that new finishing techniques permit the matching of Neolite upper material with leather or nylon mesh such as is used in perforated shoes. The use of Neolite in the tips, counters and quarters of men's footwear, in addition to the soles and innersoles, results in a more durable shoe, with increased flexibility and comfort for the wearer, the company claims. The manufacturer, using Neolite instead of leather in all upper parts except the vamp, and producing the same quality or even longer wearing men's shoes, should be able to save one to two dollars per pair over present selling costs, Goodyear stated. It was also announced that the company has developed a new "cellular" Neolite for soles and inner soles which is lighter and more flexible than regular Neolite. The new Neolite upper material is manufactured in .20 gauge thickness and up and supplied in continuous lengths.

Integrates Rubber Service Department

The Rubber Service Department of the Monsanto Chemical Co. at Akron, Ohio, has been integrated with the company's Organic Chemicals Division. The move was made to increase the company's service to the rubber industry and to broaden responsibilities of its personnel, company officials said. C. W. Christensen, general manager of sales of the Rubber Service Department, has been named assistant general manager of sales of the Organic Chemicals Division. Dr. W. P. Metzner, Rubber Service research director, has been named associate director of research for the division. Dr. John R. Durland will continue as manager of the Nitro, West Va., plant. James F. Hand, formerly assistant sales manager for the Rubber Service Department, has been named manager of sales for Rubber Service products.

Stein, Hall Opens New Plant

Stein, Hall & Co., Inc., New York, N. Y., has opened a new plant for the manufacture of Hallmark Brand industrial adhesives in both dry and liquid form at 3750 South Loomis Place, Chicago, Ill. The new three-story plant, which has 19,000 square feet of floor space and a ground area of 40,367 square feet, will be used in the formulation of adhesives to customer specifications from latex, resin, vegetable, animal and casein bases. Armond P. Coppola, formerly chemical engineer of the firm's Long Island City, N. Y., plant, has been named plant manager of the new Chicago unit. Kenneth Arnold has been named manager of the Chicago sales office. General supervision of the plant will be carried out by Lawrence Gussman, vice-president in charge of manufacturing.

LOS ANGELES NEWS

On October 15, officers of the Los Angeles Rubber Group and the president of the University of Southern California signed articles for agreement on the projected Rubber Technology Foundation. At the same time, TLARGI presented the Foundation with a check for $5,000 to purchase equipment for a rubber laboratory. The balance of the fund required for the establishment of the Foundation is being solicited from the rubber industry.

Organizations other than TLARGI who have so far contributed to the foundation include the W. J. Voit Rubber Corp., $5,000; the Union Rubber Co., $2,500; the Master Processing Corp., $2,000; the Caram Manufacturing Co., $1,000; and the Western Insulated Wire Co., $500.

TLARGI members and their guests participated in a golf tournament on August 31 at the Palos Verdes Country Club. The following members were the winners of the different events: *Blind Bogey*, Paul Karres (Rubber Teck); *Least Putts*, Skip McMahon (Cardox); *Low Net*, E. C. McLaughlin (H. M. Royal); *Low Gross*, Curt Straub (Rubber Teck); *Best Tee Shot*, Bob Bowen (Xylos Rubber); *Longest Drive*, George Foos (C. K. Williams); *Longest Putt*, Roy Phelan (Atlas Sponge Rubber).

On October 19, approximately 40 members and guests participated in another golf tournament at the Wilshire Country Club. Winners at this tournament included: *Low Gross*, Curt Straub; *Blind Bogey*, Al Federico (C. P. Hall), and Bob Johnson (Rubber Products); *Longest Drive*, Merv Adelsohn; *Low Net*, Joe Hoefle (Plastic & Rubber Products); *Best Tee Shot*, Harry Franklin (Stillman Rubber); *Longest Putt*, D. C. Maddy (Harwick Standard Chemical). This represented the last golf tournament of the 1951 season.

Ken W. Drury, formerly connected with Southwest Steel Rolling Mills, has been named purchasing agent of the Arrowhead Rubber Co., Downey, Calif. Jim Davis, former purchasing agent for the company, has been transferred to the Sales Department.

John Arensmeyer, formerly associated with the Goodyear Tire & Rubber Co., has been named chief chemist of the Golden West Rubber Co.

Kirkhill Rubber Co. held an open house on October 19 at their new plant in Brea, Calif. Plant tours were conducted by members of the Kirkhill organization and refreshments were served to visitors and guests.

C. E. Kelleher, formerly manager of the E. M. Smith plant, died in Lindwood, Calif., on September 29.

Ray Morath of the Naugatuck Chemical Division of the U. S. Rubber Co., lost his father, Joseph Morath, on the 28th of August. Funeral services were held in Kokomo, Ind.

Tommie Hoyle, associated with the B. F. Goodrich Chemical Co., married Miss Betty Ellen Lorentz, formerly of Tiffin, Ohio, on August 4 at the Baldwin Hills Baptist Church.

The Los Angeles Rubber Group has completed plans for its Annual Christmas Party to be held this year on December 7 at the Los Angeles Breakfast Club. Chairman of the various committees chosen for the party, follow: *Tickets and Table Reservations*, W. A. Fairclough; *Orchestra and Entertainment*, J. H. MacSparran, with John Repar and Milton Churchill as committee members; *Reception*, H. H. Thompson; *Prizes and Favors*, T. A. Hoyle.

The "XF9" rubber-covered football produced by the W. J. Voit Rubber Corp. made the "big time" on October 13 when it was used in a game between Georgia Tech and Louisiana State University at Atlanta, Ga. It has been announced that the use of the ball in the Southeastern Conference will be considered at a Conference meeting in December. The ball has already been adopted as official by many colleges, junior colleges and high school leagues across the nation.

Additional Rubber Road Plans

During the past few weeks various types of rubber-asphalt roads have either been laid down or planned in different sections of the country. In cooperation with the Firestone Tire & Rubber Co., a mile-long stretch of rubber road was recently laid down in Washington, D. C. About a ton of natural rubber, a synthetic compound and a highly processed form of reclaimed rubber were used in test strips. Another process for combining rubber with asphalt was demonstrated by the U. S. Rubber Co. at another test strip recently laid down in the Capital. This road, laid over an existing concrete base, consists of a combination of asphalt and a new plasticized rubber compound called "Surfa-Sealz". Firestone has already laid down a test strip in Detroit, Mich. The compound used in that city called for asphalt with 5½% of powdered rubber added. State highway officials in New Hampshire are planning to lay down a one-mile test strip. In this test, small rubber pellets will be infused into the road topping.

DuPont Rubber Lab Wins Award

Top safety honor conferred by E. I. du Pont de Nemours & Co., its "Board of Directors' Award," was recently received for the fifth consecutive time by the company's rubber laboratory at Deepwater Point, N. J. In the entire 22 years of its operation, DuPont said, the laboratory has never had a lost-time injury. The laboratory currently employs 100 people and has rolled up some 2½ million injury-free man hours. Statistics of the National Safety Council show the national average for chemical laboratories to be two lost-time injuries per million man-hours.

The photograph above shows officials of the University of Southern California and TLARGI signing the agreement which established the TLARGI Rubber Technology Foundation. Shown (background) are: Dean R. E. Vivian (USC); Bob Short (Kirkhill Rubber); Al Pickard (Braun Corp.); Deke Maddy (Harwick Standard). Shown (foreground) are R. D. Abbott (R. D. Abbott); Dr. Fred D. Flagg, Jr. (USC); Carl Hoglund (R. D. Abbott).

OBITUARIES

William W. Higgins

William Wallace Higgins, far better known as Bill Higgins, general sales consultant to the United Carbon Co. and one of the pioneers of the modern rubber industry, died on November 2 at his home in Caldwell, N. J. Mr. Higgins had undergone a prostate gland operation a few weeks previously, and was apparently on his way to recovery when complications set in. He was 73 years of age.

Born in Brooklyn, N. Y., Mr. Higgins

served with the 71st New York Regiment in the Spanish-American War. In 1902 he joined the Binney & Smith Co. as a carbon black salesman and earned the distinction of selling the first carload quantities of this relatively new material to the tire manufacturing industry. He left Binney & Smith in 1915 and acted as a sales agent for several years selling carbon black on a free-lance basis.

When the Kosmos Carbon Co. was formed in Charleston, West Virginia, in 1922, Mr. Higgins joined the company, but when the United Carbon Co. was organized and took over the Kosmos Carbon Co. in 1925, he returned to Binney & Smith in a sales capacity. However, when United Carbon began to market its own carbon black late in 1929, he joined that company as sales manager of the New York district, retaining that post until 1946 when he was named general sales consultant for the company.

Mr. Higgins was a well-known breeder of Irish setters. One of his favorites, Higgins Red Pat, won ribbons in more than eighty shows throughout the country, including the Westminster Kennel Club's show in New York. He was also very fond of flowers and raised a wide variety.

Surviving are a son, two brothers, and one sister. Mr. Higgins' wife died about a year ago. Funeral services were held on November 5 from the Caldwell home.

Lt.-Col. James Sealy Clarke

Lt.-Col. James Sealy Clarke, who rendered long and distinguished service to the rubber industry for nearly half a century, and who was co-founder of the Research Association of British Rubber Manufacturers, died on September 21 in England. He was 88 years old. Col. Sealy Clarke retired from his position with George Spencer, Moulton & Co., Ltd., in 1950. He had spent his whole business career with the company, entering its employ in 1907. Born in Barbados in 1863, he was educated at University College, St. John's College, Cambridge, and at the Royal Military College, Sandhurst. He was a South African War Veteran.

Until his retirement, Col. Sealy Clarke represented his company on various rubber industry organizations and committees. He was chairman of the Research Association of British Rubber Manufacturers from 1926 to 1933 and from 1942 to 1946 and was first president from 1933 to 1934. He continued to serve on the council of that organization until October of 1950, and remained a vice-chairman until his death. In the autumn of 1950, he resigned as a vice-president of the Institution of the Rubber Industry, having served as a member of its council since the inception of that organization. He had also served as a member of the India Rubber Manufacturers' Association and subsequently participated in the formation of the Federation of British Rubber Manufacturers' Associations which succeeded IRMA.

Col. Sealy Clarke was for 10 years chairman of the Royal Automobile Club of which he became a member in 1903. He also served as president of the Society of Motor Manufacturers and Traders in 1924-25 and was past-president of the Motor Trade Association. He leaves his wife.

Edgar B. Davis

Edgar B. Davis, wealthy oilman and philanthropist who amassed a rubber fortune in Sumatra, died on October 14 in Galveston, Texas. He was 78 years old. A native of Brockton, Mass., Mr. Davis went to Sumatra shortly after the turn of the century for his health and made a great deal of money dealing in rubber. He is credited with influencing the U. S. Rubber Co. to begin operating its own plantations in both Malaya and Sumatra, although he was never officially associated with that company. In the 1920's he came to Texas and placed the fortune in six dry oil tests. Then he borrowed money to drill a seventh near Luling. It came in a gusher in 1922. In 1926 he sold out to the Magnolia Petroleum Co. for $12,000,000. Mr. Davis was widely known for his philanthropies and in 1927 endowed for $1,000,000 the Luling Foundation, a school where boys could earn their way while learning scientific farming.

Russell D. Belden

Russell D. Belden, vice-president of the Dunlop Tire & Rubber Corp., Buffalo, N. Y., died suddenly on September 27 while on a fishing trip in Timagami, Ont., Canada. A native of Akron, Ohio, Mr. Belden attended schools there and was graduated from Buchtel College, now Akron University. Throughout his school

years he participated in athletic events and was an ardent sports lover all his life. After graduation, Mr. Belden was employed by the Miller Rubber Co., Akron, then in 1918 went to the Marion Tire & Rubber Co. of Marion, Ohio. In 1920 he moved to Buffalo where he was made production superintendent of the Madison Tire Co. In 1923 he joined Dunlop Tire as technical manager. He was appointed vice-president in charge of manufacturing in 1930. Mr. Belden was a member of the Buffalo Athletic Club and the Park Century Club. He is survived by his wife and one son.

Mrs. A. A. Somerville

Mrs. Emma Louise de Rapelye Somerville, wife of Dr. A. A. Somerville, vice-president of the R. T. Vanderbilt Co., New York, N. Y., died at their country home in Carmel, N. Y., on October 13. She was 62 years old. Mrs. Somerville was a graduate of Barnard College and belonged to the Daughters of the American Revolution, the Colonial Dames of America, the Holland Dames and the Huguenot Society. She had been an active supporter of the Berkshire Farm Colony for underprivileged boys. Besides her husband, Mrs. Somerville leaves two sons and two daughters.

Emanuel Friedman

Emanuel Friedman, who with his brothers, Leo and Arthur, founded the Chemical Rubber Co. of Cleveland, Ohio, in 1903, and the Cleveland Heater Co. three years later, died on October 7 in Cleveland. He was 70 years old. At his death, he was vice-president of the rubber company and secretary of the heater concern. His brothers survive.

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James P. Chittum

James Paul Chittum, technical sales representative for Kralastic and Vibrin resins for the Naugatuck Chemical Division, U. S. Rubber Co., died on October 3 at a hospital in Waterbury, Conn., after a lengthy illness. He was 39 years old. Born in Wapello, Iowa, Dr. Chittum joined U. S. Rubber in 1937 as a research chemist in the general laboratories at Passaic, N. J. There he did much of the fundamental research work which led to the company's entry into the plastics field. He was a widely known authority on polyester resins and the styrene resin-nitrile rubber blends. For the past five years he had helped introduce these resins to the plastics industry as a technical sales representative for Naugatuck Chemical. As their popularity grew, he assumed the responsibility for sales in the New England territory. Dr. Chittum held a doctor's degree in Chemistry from Columbia University. He was a member of the American Chemical Society, the Society of Plastics Engineers, the Society of the Plastics Industry and the American Plastics Association. Funeral services were held at the First Methodist Church in Waterbury on October 6.

Arthur H. Zieske

Arthur H. Zieske, vice-president and general manager of Goodyear Farms, Litchfield Park, Ariz., died on October 24 in St. Joseph's Hospital, Phoenix, Ariz. He was 61 years old. Mr. Zieske joined the Goodyear Tire & Rubber Co. in 1910 at Akron as a draftsman for the mechanical engineering department. Later, he was placed in charge of the drafting room and then, in addition, construction supervision of the work as well. He went to Gadsden, Ala., in 1929 where he engineered the construction of the company's factory there. In 1933, he went to California to take over the assignment of restoring the company's plant at Los Angeles following the damage caused by the earthquake of March of that year. Prior to that he had been in England looking over the present site of the company's tire plant at Wolverhampton. Mr. Zieske was assigned to Goodyear farms in October, 1933, as manager. He was appointed vice-president of Goodyear Farms in 1940. He is survived by his wife, two sons and a daughter.

Carl D. Humphreys

Carl D. Humphreys, assistant research director of the General Cable Corp. at Bayonne, N. J., died at his home in Westfield, N. J., on November 1. Death came while he was trying to repair a faulty oil burner, and physicians could not determine whether it was due to a heart attack or electrocution. Mr. Humphreys, who was 39 years old, was born in Pasadena, Calif., and joined General Cable several years ago as a research chemist, later being advanced to assistant research director. He was a member of the American Chemical Society. His wife and four children survive.

LABOR NOTES

A month-long strike against the U. S. Rubber Co. at Eau Claire, Wis., was ended on October 29 when a new agreement was signed between the union local and plant management. The new agreement is said to provide for improved seniority provisions and time-and-a-half on Saturday for employees who are sent home early through no fault of their own.

A four-week strike at Republic Rubber in Youngstown, Ohio, was ended on October 29, and operations were resumed. Members of the union local voted to accept a company offer to make retroactive to July 30 instead of August 6 a 13-cent-an-hour pay increase. The company also agreed to submit to arbitration a union demand to employ two night nurses.

An agreement was signed on October 12 between the Midwest Rubber Reclaiming Co. at Barberton, Ohio, and East St. Louis, Ill., and the URW local calling for a 13-cent-an-hour pay raise for the company's 500 workers. The settlement also calls for a full union shop, according to union officials.

Strikes caused temporary shut-downs last month at the plants of the Ohio Rubber Co. at Willoughby, Ohio, and Connecautville, Penna., and the Firestone plant at Pottstown, Penna. The latter was an unauthorized strike by workers protesting the employment of outside contractors on maintenance work.

Drogin Speaks on Carbon Blacks

Dr. I. Drogin, director of research for the United Carbon Co., Charleston, West Va., addressed the September 27th meeting of the Philadelphia Printing Ink Makers Production Club on the subject "Some Aspects of Ink Grade Carbon Blacks." Dr. Drogin defined ink grade carbon blacks and briefly described their manufacture by the channel and furnace processes and their physical and chemical properties. He discussed the classification of ink grade carbon blacks by their suitability for different types of inks, the applications of short and long flow blacks, and that of furnace blacks. He pointed out the trends of furnace blacks in the printing ink industry, and the advantages and disadvantages of these blacks in inks as compared with channel blacks. Dr. Drogin also discussed the use of pelleted, or beaded, blacks in inks. Finally, he presented a comparison of the physical and chemical properties of fifty ink black grades and their performance characteristics.

Woloch Takes Larger Quarters

The George Woloch Co., dealer in rubber and plastics, has moved to new and larger quarters at 82 Beaver St., New York 5, N. Y. The firm was previously located at 61 Broadway. The new telephone number is HAnover 2-1171.

Jacob H. Linxweiler

Jacob H. Linxweiler, president of the Intercontinental Rubber Co., New York, N. Y., died on October 10 in Norwalk Hospital, Norwalk, Conn. He was 60 years old on that day. Mr. Linxweiler had been associated with the Norwalk Tire & Rubber Co. from about 1917 until April, 1927, when he became sales manager for the Intercontinental Rubber Co. Intercontinental, through its affiliate, Continental-Mexican Rubber Co., produces guayule rubber at Torreon, Mexico. Mr. Linxweiler resigned from his position with Intercontinental in September, 1947, to take a position with Spring Mills, Inc., of New York, N. Y. However, he remained on the board of directors of Intercontinental Rubber Co. and its subsidiary. In June of 1950, Mr. Linxweiler resigned his position with Spring Mills to take the presidency of the Intercontinental company and its Mexican subsidiary. Funeral services were conducted in South Norwalk, Conn., with interment in Riverside Cemetery, Norwalk. His wife, a son and a daughter survive.

William K. Brown

William Kenneth Brown, formerly associated with the Firestone Tire & Rubber Co., died recently in Buenos Aires, Argentina. In the 1930's, Mr. Brown had been factory manager of the Firestone plant in Buenos Aires. He had also been associated with the company in Akron, Ohio, and at Los Angeles, Calif. Since 1946, Mr. Brown had been rubber consultant for a Buenos Aires firm. Funeral services were held in Buenos Aires and burial was there. His wife and son survive.

Clarence W. MacLellan

Clarence W. MacLellan, vice-president of the Tillotson Rubber Co. of Needham, Mass., died suddenly at his home in Needham on October 25. Mr. MacLellan was a member of the Nehoiden Lodge, A. F. & A. M. and the Needham Rotary Club. Funeral services were held at Needham Heights with interment in Forest Dale Cemetery, Malden, Mass. His wife survives.

James N. Cooke, Sr.

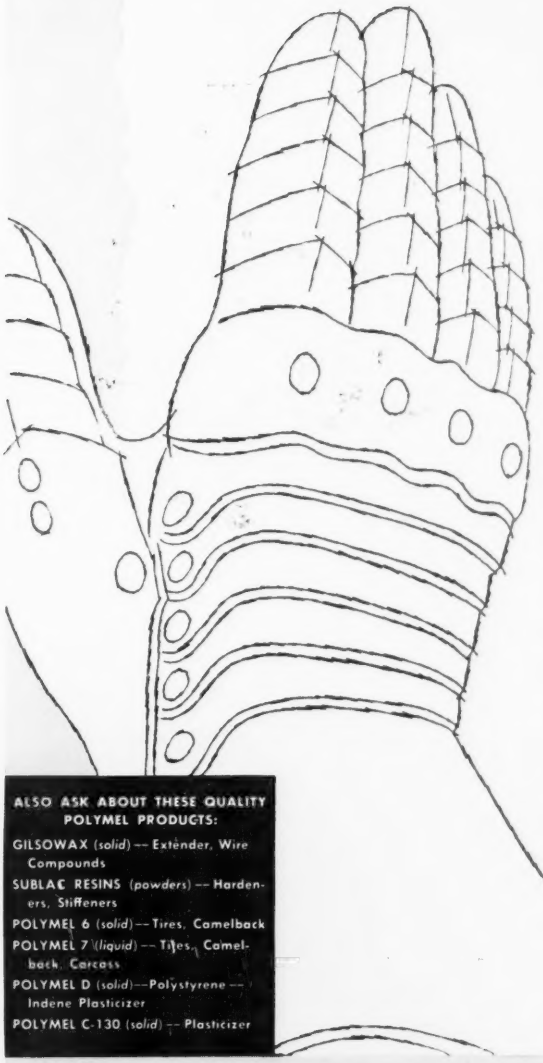
James N. Cooke, Sr., founder and president of the Cooke Color & Chemical Co., Glen Rock, N. J., passed away recently. A complete obituary on Mr. Cooke will appear in an early issue of RUBBER AGE.

New Rubber Compounding Course

A course in principles of rubber compounding is now being given at the Illinois Institute of Technology. Dr. A. G. Susie is directing the course, assisted by F. Warren Bickel, both of the Armour Research Foundation. The course at present does not carry a credit rating, but it is hoped that it will be on an accredited basis next year.

a challenge

to compounders of natural or synthetic rubber!



Try a free production sample of d-TAC, the new, non-coloring, powdered resin that reduces tackiness and milling time. Prove to yourself that d-TAC actually eliminates the problem of sticking to mill rolls!

Here are three reasons why leading rubber producers are turning to sensational new d-TAC to reduce costly tackiness in natural and synthetic rubbers!

1. VERSATILE—performs equally well in highly loaded natural or synthetic rubber batches. d-TAC has no effect on the cure or physical properties.

2. EFFICIENT—even in small quantities. You use only 1 to 6 parts of d-TAC on the rubber, depending upon the degree of tack to be reduced.

3. ECONOMICAL—d-TAC costs but 22c per pound, f.o.b. plant in l.c.l. quantities.

WRITE TODAY for your free sample of d-TAC and see for yourself how quickly you can put an end to milling problems, thus increasing the capacity of your mills.

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Trenton, N. J.
Western: Merit Western Co.
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You'll cut costs, too, with--

The HOLMES
CRUDE RUBBER
BALE CUTTER

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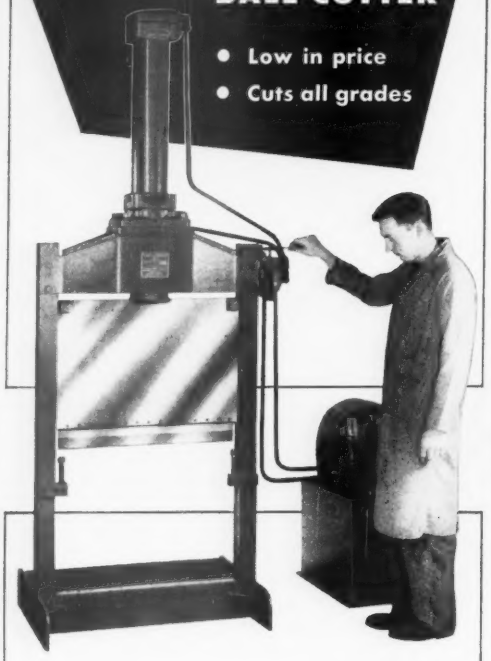
- Cuts all grades



Special control valve...set high up ...reduces injury hazard--makes it one of the safest cutters on the market

Top performance...low operating cost...maximum safety--these are the three main reasons why the Holmes Crude Rubber Bale Cutter is in daily use in so many leading plants in the rubber industry.

As illustrated, it is a complete, self-contained unit with pump, tank, and 5 H.P. motor. Knife--29¼" wide. Stroke--23". Height--8' 5". Floor Space--36" x 64". And--the initial cost is low.

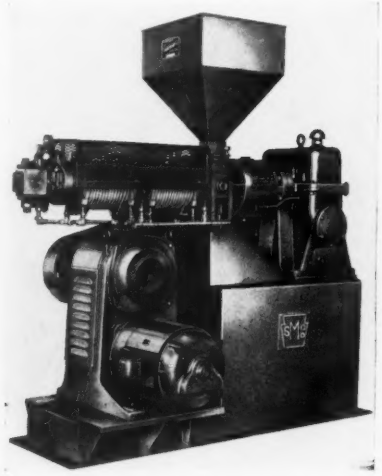
WRITE OR WIRE FOR SPECIFIC DETAILS--regardless of your particular requirements. With 50 years know-how specializing in machinery and molds for the rubber industry--Holmes can help you solve your problems, too, as they have for so many others. No obligation, of course.

Stanley H. HOLMES Company
Successor to Holmes Bros., Inc.
440 N. Sacramento Blvd., Chicago 12, Ill.

NEW EQUIPMENT

Therma-Fin Heater-Cooler Jacket

A new heater-cooler jacket for extruding machine cylinders has been developed by the Standard Machinery Co., Mystic, Conn. Named the Therma-Fin Heater-Cooler Jacket, the unit is a finned aluminum jacket with electrical heating elements and stainless steel cooling

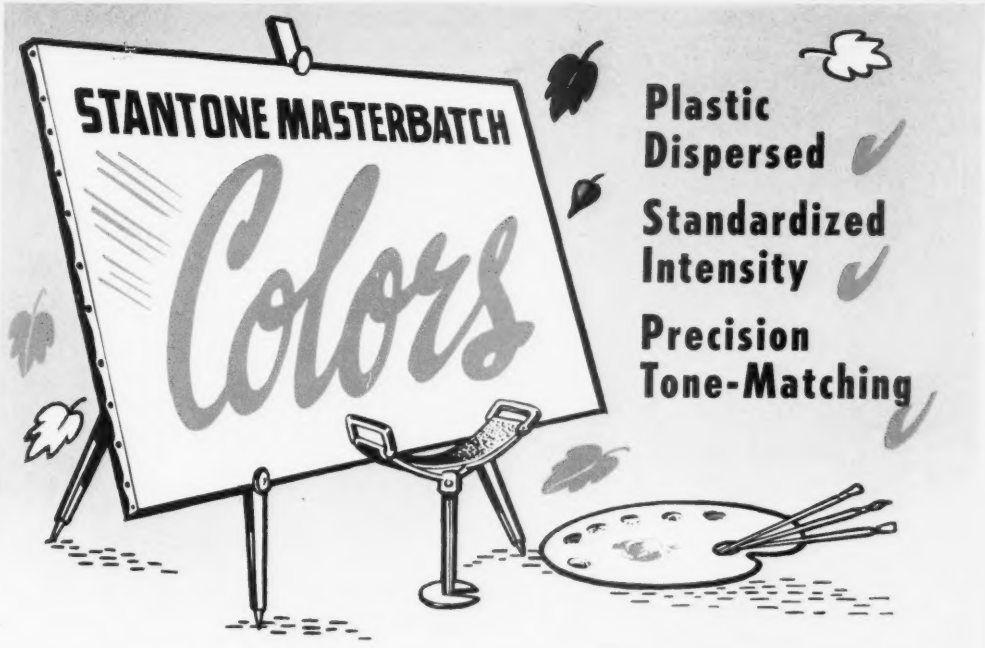


passages cast integral. Field tests have indicated temperature control to be most accurate with this new unit. The company is restricting Therma-Fin Jackets to original equipment at present due to current business volume. However, the company hopes to be in a position to furnish the units for other machines at some later date.

Cabot's NEW
Low-Cost Oil Furnace Black!

Sterling-V
(V for VERSATILE)

EXCELLENT IN TREAD BASE!



• STANTONE MASTERBATCH Colors are emulsion-dispersed in plastic, precipitated and standardized in color intensity . . . Color compounding is simply a matter of mathematical accuracy when particular shades are to be matched, or when special colors are desired. With STANTONE MASTERBATCH COLORS mills may be changed from one color mix to another without intermediate cleaning . . . Here's vital time-saving for many manufacturers that makes a valuable showing on production-cost records . . . Yes, ease of handling, color accuracy and saving in mill-room time all contribute to SAVING with STANTONE MASTERBATCH COLORS.

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DRY POWDER FORM — for general compounding use.

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. . . Also color dispersions in polyethylene and other resins.

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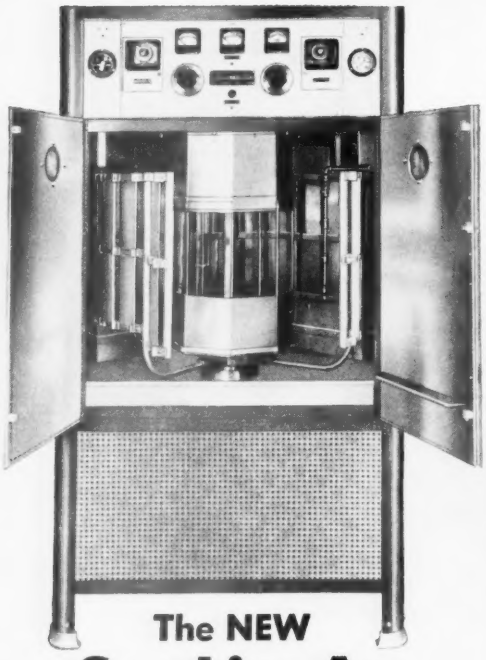
For complete information on colors for any compounding purpose.

HARWICK STANDARD CHEMICAL CO.
AKRON, OHIO
BRANCHES: BOSTON, TRENTON, CHICAGO, LOS ANGELES



The NEW

Sunshine Arc Weather-Ometer

Type XW

A modernized and redesigned version of the open flame X-1 and X-1-A Weathering Units

Many of the control features that have proven their dependability in the Atlas Twin Arc Weather-Ometer have been combined with some features of the original X-1-A weathering unit to make a new Weather-Ometer of advanced design.

In the Type XW a new means of maintaining constant temperature is provided. Far more accurate temperature control is now available.

Radiation is from a Sunshine Carbon Arc which is of the motor-driven, open-flame type. Natural sunlight or intensified ultra-violet radiation is available depending upon the type of carbons and filters used. The light source has been improved to provide 16 hours of continuous operation as well as a number of other added conveniences.

All instruments are located on a convenient control panel, including an arc voltage setting switch and meter, cycle control of light and water spray, 1 to 24 hour shut-down time switch, thermo-regulator and running time meter.

Type XW is fully automatic and may safely be left in unattended operation overnight. If deionized water is to be used, aluminum spray piping can be furnished. The capacity of the stainless steel lined testing chamber is 54 panels. The machine is sturdily constructed and is shipped assembled, ready for connection.

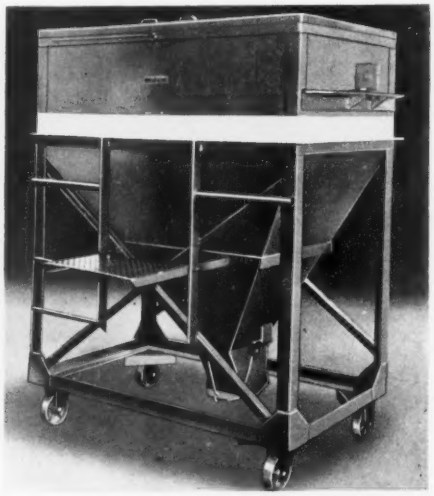
ATLAS ELECTRIC DEVICES COMPANY

361 West Superior St., Chicago 10, Ill.

FADE-OMETERS • LAUNDER-OMETERS • WEATHER-OMETERS

Klaas Portable Storage Hopper

Serving as a temporary storage medium, the Portable Storage Hopper developed by the Klaas Machine & Manufacturing Co., 4320 East 49th St., Cleveland 25, Ohio, becomes a conveyor of material as the material is needed. As a container, it is ideal for dry pre-mixed batches such



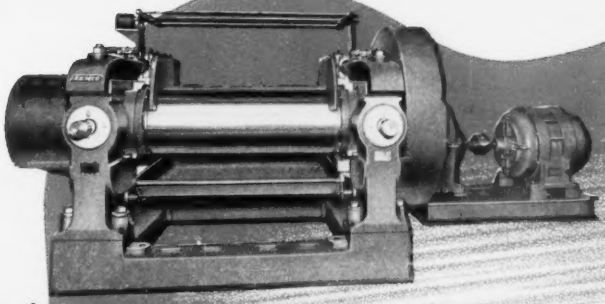
as are required in rubber, glass, chemical and enameling plants. The hopper has a bottom dump to facilitate charging the material from above into a furnace. The storage-conveyor-dump unit is made of welded sheet metal and structural steel frame. The wheels not being fixed, movement of the unit can be in any direction. The unit is 48 inches long, 6 feet high and has a capacity of one cubic yard.

Cabot's NEW Low-Cost Oil Furnace Black!

Sterling V

(V for VERSATILE)

IDEAL FOR INSULATED WIRE!



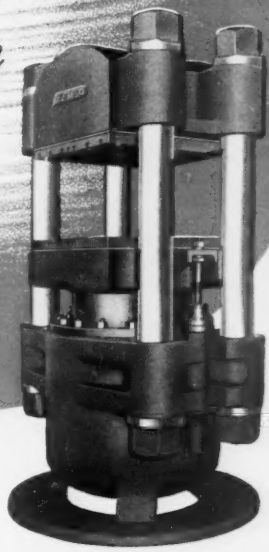
Heavy-duty Mills, in all sizes up to 84 inches, featuring extra heavy construction, smooth operation, and long life.

Laboratory Mills furnished with built-in motor, control and adjustable speed drive. Entirely enclosed ready to operate. Mechanism is readily accessible.

FAST DELIVERY LOW UPKEEP MORE PROFITS

When You Specify EEMCO

42—ton Laboratory Presses, entirely self-contained, equipped with 12"x12" platens, occupying floor space of only 14"x36". Have adjustable opening.



Presses for compression, transfer molding, laminating, and polishing. All sizes and types. Custom built.

FAST DELIVERY because **EEMCO** operates its own modern foundry and machine shop, and has every facility including a large stock of motors, controls and component parts at hand at all times.

LOW UPKEEP due to expert construction and long life of the **EEMCO** line which is made in a factory with more than 30 years experience in rubber and plastic machinery.

MORE PROFITS because **EEMCO** fast delivery enables you to get into production sooner, and its long life and sturdy construction assures you of a minimum amount of "shut-down" time.

- MILLS
- PRESSES
- CRACKERS
- WASHERS
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RUBBER AND PLASTICS MACHINERY DIVISION

Cut Your Downtime
on mill roll changing
to 1 Minute or Less
with the NEW B&S
SHAFTLESS BACKSTAND

Money-consuming downtime on mill roll changing is cut to the bone by the wholly automatic B & S Shaftless Backstand. Here is what Mr. C. Carr Sherman, President of H. P. Smith Paper Co., has to say about this equipment:

"The engineering of this new unit indicates a fine understanding of the problems of the users of this type of equipment. The Backstand is much easier to handle as there are no shafts. It is also much easier and faster to make changes on it. I believe that changing rolls with this Backstand can be brought down to well under one half minute."

You may purchase the B & S Shaftless Backstand with or without the new B & S Slitter and Rewinder. The Backstand may be used on any type of rewinding equipment, as well as on waxing and laminating machinery, printing presses, etc.

For full details on the Shaftless Backstand and the new B & S Slitters and Rewinders, write to The Bagley & Sewall Company, 500 Fifth Avenue, New York 18, N. Y.

THE B & S
#55 SHAFTLESS BACKSTAND
features automatic tension and side register control; motor for raising and lowering mill roll arms, also motor for moving the arms to accommodate different width rolls. Entire working mechanism is totally enclosed.

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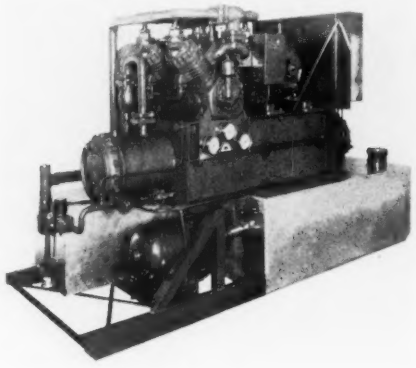
Mayer Chil-er Unit

As complete as a household appliance, an industrial water or brine cooling unit has been announced by Mayer Refrigerating Engineers, Inc., Rutherford, N. J. The new unit is entirely self-contained and ready for operation when connected to water and power lines.



One push button controls a continuous, automatic supply of recirculated chilled water or brine at the temperature and volume required.

The unit, designed for heavy duty cooling, includes a high head, high volume water circulating pump, storage tank and complete auxiliary equipment assembled on permanent steel skids that eliminate the necessity of any foundation or bolting down. It is compact enough to clear through standard doors and can be easily re-located and used for other cooling requirements.

The unit operates on either gravity or pressure water return without an additional pump and automatically adjusts to variable load and flow. The temperature range is adjustable. The units are manufactured in eight sizes.

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(V for VERSATILE)
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The greater uniformity of Mt. Vernon fabrics means *consistent* quality in your finished products — smoother, more efficient fabrication.

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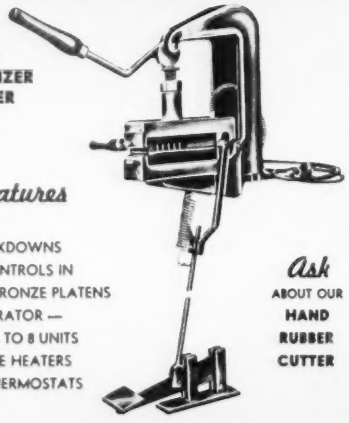
Hand Grip Rubber Gauge No. 3-B

Height	9"	Length	9¾"	Range	½"
Depth of Throat	6½"	Dia. 50 Divisions Each Div. 1/1000"		Weight	4 lbs.
				Frame	Aluminum

Designed for gauging stock as it is coming from the calender.

FRANK E. RANDALL CO., Inc., Waltham 54, Mass.

THE SMACO GASKET SPLICER



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Features

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- ONE OPERATOR — FROM 1 TO 8 UNITS
- LONG LIFE HEATERS AND THERMOSTATS

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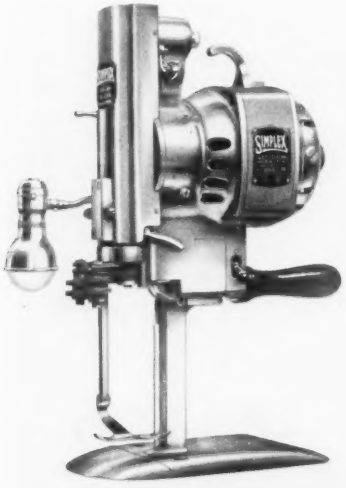
Simplex Dual Edge Sharpener

The design of the Electromatic Dual Edge Sharpener Cloth Cutting Machine, manufactured by the Simplex Cloth Cutting Machine Co., 270 West 39th St., New York 18, N. Y., permits its use in the cutting of sponge rubber and rubberized material. The unit features no



changing of knives, with just a twist of a knob changing the knife edge from rough to smooth and vice versa. The unit has a patented "Dual Edge" device which changes the speed of stones and the up and down travel while sharpening. An even presser foot gauge releases automatically when the sharpener key is pressed, thus saving one labor operation.

Cabot's **NEW** *Low-Cost Oil Furnace Black!*

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(V for VERSATILE)

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Utility Crimper Type Flipper

for

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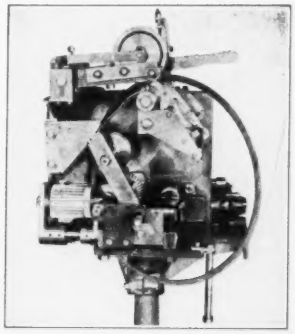

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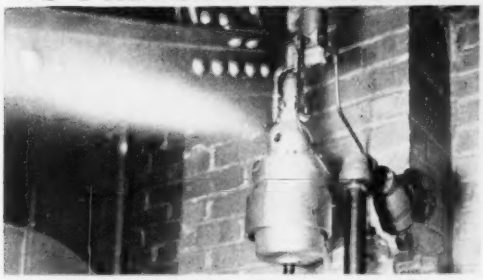

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ARMSTRONG air-controlled Steam Humidifiers are worth their weight in gold wherever explosive vapors are present. By adding steam directly to the air, these units automatically maintain the relative humidity necessary to dispel any chance of a static electricity spark.

Simple, wholly dependable and economical, Armstrong Steam Humidifiers have been thoroughly tested and proven in rubber cement house applications. Humidifiers can be shipped from stock, ready for easy installation. GUARANTEED TO SATISFY or your money back.

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Positive Protection Against

Static Explosion Hazard

***Send for this bulletin*—12-page bulletin 1772 gives complete information and prices.**

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COSTS GOING *DOWN? TODAY?*

Why, sure!

LOWER CURE COSTS

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MARTIN

All-Nylon Cure Wrapping Tape

Slash total tape expense

Get up to 60 curings from Martin longer-lasting All-Nylon Tape. Get 7 to 10 times more service than from cotton tape.

Produce a better finish

Get greater natural smoothness faster. Martin All-Nylon Cure Wrapping Tape often eliminates a buffing operation.

Thermoid Company, Trenton, New Jersey, depends on Martin All-Nylon Cure Wrapping Tape

Check these superiorities:

Looped edge • Natural color • Standard widths in stock (1¾", 2", 2¼", 2½", 2¾", 3⅛", 3½") • Special widths on request • Put-up, 72 yard rolls, or to order

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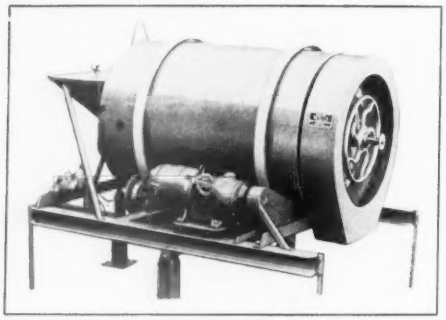
WILLS "SUB-ZERO" ROTARY TUMBLERS



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Holds lowest temperature, with minimum "Dry Ice" consumption, by reason of our method of complete insulation. Has wide loading end hopper. Unloads automatically into tote boxes or conveyor. Product can be inspected while tumbler is rotating. Equipped with variable speed control motors. Ruggedly constructed, available in two sizes. Suitable for use with other deflashing aids or dry tumbling.

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(Export Sales Through Binney & Smith, International)

Here is a valve that EASILY reduces pressures as high as

6,000 lb. per sq. in.

Many rubber factory operators still do not know about this remarkable high pressure reducing valve. They *should* know that this

ATLAS Type "E"
High Pressure Reducing Valve

is being used in the leading rubber factories of the world, continually handling the highest pressures *without shock*—oil, water, or air—saving much money and eliminating all high pressure headaches.

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Johnson Corp., Three Rivers, Mich., has announced that the self-supporting Type S Johnson Joints are now available in heavy duty construction suitable for operating pressures up to 250 pounds. Pressure itself acts as the sealing force—fills the entire housing and forces the seal ring tightly against the collar. A spring is provided in the joint, but this serves only for initial seating. The rear portion of the nipple serves as a bearing surface, and is carefully machined. It rotates in a large carbon-graphite guide, which in turn is fitted carefully inside the body. It is this construction which is said to support the joint and permits it to shift as the roll shifts so there can be no danger of misalignment.

Behr-Manning Corp., Troy, N. Y., has announced the development of a **coated abrasive belt sanding unit**, especially designed for inside diameter sanding, grinding and polishing work. Called the Tongue Sander, the unit is adaptable to either free running or platen-backed coated abrasive belt operations.

Superdraulic Corp., 14256 Wyoming Ave., Detroit 4, Mich., has introduced a special **hydraulic test stand** for testing flexible hose used in aircraft. The test stands are built to provide test pressure up to 5,000 psi using large volume pumps and up to 30,000 psi with special booster equipment.

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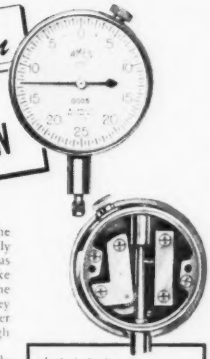

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REVIEWS

BOOKS

Rubber's Home Town. By Hugh Allen. Published by Stratford House, Inc., 52 Vanderbilt Ave., New York 17, N. Y. 5½ x 8¼ in. 266 pp. $3.75.

Although sub-titled "The Real Life Story of Akron," this book, the fifth volume of the American Heritage Series covering selected cities of America, is more aptly a story of people. Through its pages parade the long list of individuals who have written, and are still writing, the history of Akron. Because of its unique position in the rubber manufacturing field, many of these names are familiar, among these being F. A. Seiberling, C. W. Seiberling, Paul Litchfield, Harvey Firestone, William O'Neil, John W. Thomas, C. B. Raymond, J. D. Tew, W. W. McMahan, and C. K. Quine. Other personalities, because of the marks they have left on American industry, are also familiar, such as Ohio C. Barber, Ferdinand Schumacher, Edwin Shaw, Bert Polsky, Hugh Allen Galt, Fred Harpham, Charles Herberich, and Ernest Pflueger.

The story of Akron is of course the story of rubber and accordingly the role played by rubber in the growth of the city since the turn of the century receives major attention, with special chapters devoted to The Age of Rubber, How Rubber Came to Akron, Goodyear and Firestone, Rubber Becomes Big Business, etc. Some of this history has been told before but Hugh Allen's graphic style makes it all sound new and more interesting than ever. Before the reader is finished with the book he will understand why Akron is a more familiar name in far-away Rio de Janeiro and Singapore than even New York. The book has a foreword by Lloyd C. Douglas. There is also an appendix giving the story of Portage Path, biographical sketches of Akron personalities, and a chronology of Akron events.

•

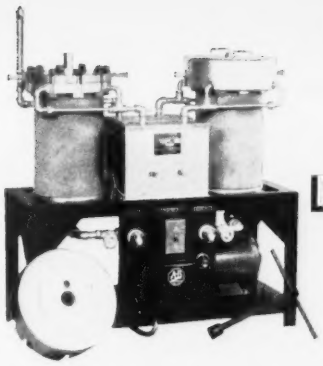
A Practical Manual of Rubber Hardness Testing. By A. L. Soden. Published by Maclaren & Sons, Ltd., Stafford House, Norfolk St., London, W.C.2, England. 6 x 8¾ in. 50 pp. Price: 6s 0d ($1.25 U.S. and Canada).

The series of articles by Dr. Soden on rubber hardness tests which were published in the *India-Rubber Journal* during the early part of 1951 has now been published in the form of a manual, with a rigid cover. In the manual, the author first discusses the simple theory of indentation hardness tests and then, in turn, covers the standard tests, the factors affecting the design and use of hardness instruments, and the method of use and calibration of the more important instruments currently in use. In addition, relevant conversion tables are furnished in the form of appendices and an extensive bibliography of 54 references is included. This is a practical manual which should prove of value to all those concerned with hardness testing of rubber.

•

Modern Plastics Encyclopedia and Engineer's Handbook: 1951: Published by Plastics Catalogue Corp., 575 Madison Ave., New York 22, N. Y. 8¼ x 11¼ in. 638 pp. $2.00.

A drastic change in publication style has been made in this latest edition of the Modern Plastics Encyclopedia, the 15th to be issued. In order to make the book more directly useful to more people in the industry and among end users of plastics, the data which has become standardized through the years has been omitted and the book now tells in detail what is new during the past year in plastics materials, applications, machinery, engineering and techniques. A special 40-page section is devoted to "Plastics in Defense." The directory section has been expanded in all departments and includes, for the first time, a section on Reinforced Plastics. Other valuable portions of the book include statistics of the industry, a plastics properties chart, and an extensive bibliography of reference books.



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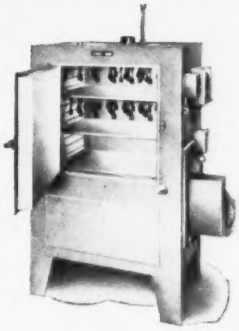

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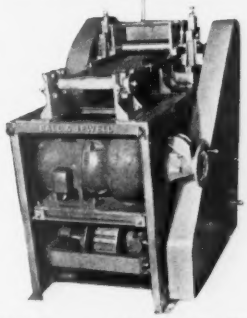

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Organic Reactions. Vol. VI. Edited by Roger Adams. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 6 x 9 in. 518 pp. $8.00.

The current volume continues the work launched several years ago by a special editorial panel under the directorship of Dr. Adams of compiling critical discussion of the more important organic reactions. Each chapter in this series is prepared by outstanding experts in the field and is devoted to a single reaction, or a definite phase of a reaction, of wide applicability. The subjects are presented from the preparative viewpoint and each chapter includes several detailed procedures illustrating significant modifications of the methods discussed.

The present volume is divided into 10 chapters, as follows: (1) The Stobbe Condensation; (2) The Preparation of 3,4-dihydroisoquinolines and Related Compounds by the Bischler-Napieralski Reaction; (3) The Pictet-Spengler Synthesis of Tetrahydroisoquinolines and Related Compounds; (4) The Synthesis of Isoquinolines by the Pomeranz-Fritsch Reaction; (5) The Oppenauer Oxidation; (6) The Synthesis of Phosphonic and Phosphinic Acids; (7) The Halogen-Metal Interconversion Reaction with Organolithium Compounds; (8) The Preparation of Thiazoles; (9) The Preparation of Thiophenes and Tetrahydrothiophenes; (10) Reductions by Lithium Aluminum Hydride. A subject index is included.

•

Harvey Firestone: Free Man of Enterprise. By Alfred Lief. Published by the McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 18, N. Y. 5½ x 8 in. 324 pp. $3.00.

Any biography of Harvey Firestone must of necessity trace the growth and development of the American rubber manufacturing industry. This latest biography of the founder of the Firestone Tire & Rubber Co. follows that pattern in a lively and engrossing manner, with natural concentration on Firestone the man. The whole story of the Firestone empire with its international ramifications is told in this book from the time that Harvey Firestone left his job as a buggy salesman in Chicago to launch the Firestone-Victor Rubber Tire Co. in that city up to the present day activities of the Akron concern. The personal contacts enjoyed by Mr. Firestone with such personalities as Thomas A. Edison, Henry Ford, and John Burroughs are dwelt upon and the humaneness of his many activities are stressed. As Allen Nevins states in the foreword to the book, readers will find different focuses of interest in it. To some, it will read as a success story, to others it will represent an illustration of the way in which American businessmen learned to think in terms of human relations, but to most its chief interest will lie in its picture of American character.

Roads Rough?
SEE PAGE 144

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Eléments de Science et de Technologie du Caoutchouc. (Elements of the Science and Technology of Rubber). Edited by Jean Le Bras. Published for the French Rubber Institute by Societe d'Editions Techniques Coloniales, 3, Square Petrarque, Paris 16e, France. 6 x 9½ in. 330 pp. In French.

For many years the French Rubber Institute has been conducting special courses in rubber, particularly for young students who wish to become rubber engineers and technologists. These courses have been of an elemental nature and are designed to acquaint the students with the numerous branches of the overall rubber industry, from planting to manufacture. Naturally, in the course of such education, details concerning the science and technology of rubber enter into the picture, and this new book, which is actually a manual, should prove of considerable help. M. Le Bras has gone a step further and included a good deal of technical information which will prove of value to rubber chemists and technologists in general.

The book is divided into 15 chapters, as follows: (1) General; (2) Sources and Harvest of Rubber; (3) Composition and Properties of Rubber; (4) Physical Properties of Rubber; (5) Chemical Composition and Structure of Rubber; (6) Chemical Properties of Rubber; (7) Vulcanization; (8) Compounding Ingredients and Their Use; (9) Processing of Rubber; (10) Analyses and Tests of Rubber Latex; (11) Hard Rubber, Reclaimed Rubber, Chemical Derivatives; (12) Direct Use of Latex; (13) Synthetic Rubbers; (14) Theoretical Aspects of the Chemistry of Rubber; (15) Applications of Rubber. In addition, subject and author indexes are included, as is a list of books and other works in French on the general subject of rubber.

•

The Statics of the Tire. Compiled and issued by C. M. Sloman, 5777 Harvard Road, Detroit 24, Mich. 8½ x 11 in. 45 pp. $5.00.

There is no questioning the statement that tires of today represent a vast improvement over their predecessors. However, as measured against the performance of the vehicle, there is still room for improvement. The author of this treatise is of the opinion that if methods of calculation for what goes on internally in the tire structure can be developed, then the use of such methods can make attainable the optimum in tire performance. The treatise has for its purpose the evaluation of changes in contour of the various portions of the loaded pneumatic tire, the ultimate objective of the work being the calculation of stress-strain relationships in the materials of the tire. The author readily admits that this treatise can serve only as the groundwork for the mathematics of tire design. Nevertheless, the theorems offered for the distortion of inflated cylindrical envelopes under external loading and for inflation stress, cord paths, and deflection of the torus may be considered as a valuable tool which, in skilled hands, can help fashion the ideal in tire performance. This treatise should prove of extreme value to tire engineers in particular and tire technologists in general.

•

The Surface Chemistry of Solids. By S. J. Gregg. Published by the Reinhold Publishing Corp., 330 West 42nd St., New York 18, N. Y. 5½ x 8½ in. 298 pp. $8.50.

This book is a systematic survey of the various branches of the surface chemistry of solids. It deals with all those chemical and physico-chemical phenomena which relate to the activity of the surface of a solid, or to the interface between a solid and a gas, a liquid or another solid. Many of these phenomena, such as the adsorption of gases and vapors, the spreading of a liquid over a solid, catalysis and adhesion, are treated with a consistent viewpoint as far as practicable. The author summarizes and evaluates the theories of leading workers in these fields. Emphasis throughout is on general principles in order to simplify an exceedingly complex subject for the benefit of students and others who are not well versed in physical chemistry. The book is divided into 15 chapters and includes author and subject indexes.

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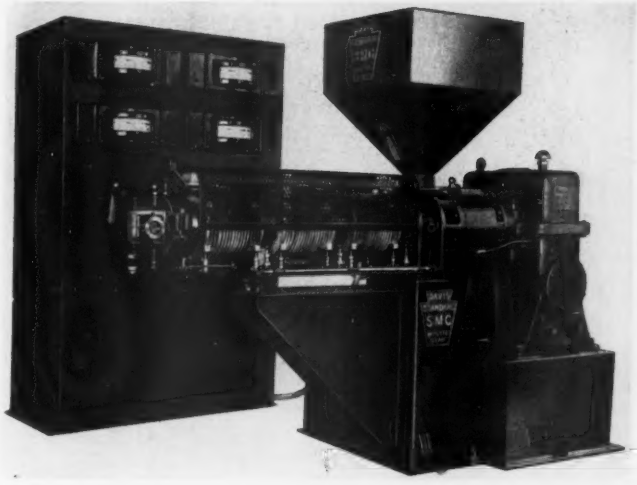

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Characteristics of Measuring Circuits used in Brown Electronik Potentiometers. (Bulletin B15-13). Brown Instruments Division, Minneapolis-Honeywell Regulator Co., Wayne and Windram Aves., Philadelphia 44, Penna. 8¾ x 11¼ in. 16 pp.

The characteristics of the measuring circuits used in the Brown Electronik Potentiometer are discussed in this bulletin. The standard potentiometer measuring circuit is described as to its resistor functions and standardizing. Span limitations, potentiometer calculations, system damping, A-C measurements and circuit variations are all detailed. Much of the information presented is in diagrammatic and chart form.

•

Sterling V. Godfrey L. Cabot, Inc., 77 Franklin St., Boston 10, Mass. 8½ x 11 in. 4 pp.

Some technical data on Sterling V, the newest member of the Cabot oil furnace black family which is said to combine the modulus of HMF, the resilience of SRF, and the smooth extrusion of a typical oil black, is offered in this multi-colored brochure. The brochure contains a brief description of the new black, some suggested applications, and data on tensile, modulus, rebound and die swell in comparison with Sterling S (SRF) and Sterling L (HMF). Cabot has proposed a new classification for Sterling V, namely, GPF, general purpose furnace.

•

The Crisis in Sulphur. By Langbourne M. Williams, Jr. Freeport Sulphur Co., 122 East 42nd St., New York 17, N. Y. 4⅜ x 5¾ in. 40 pp.

This interesting booklet, written by the president of the Freeport Sulphur Co., takes under consideration the matter of the present shortage in sulfur throughout the world. The author explains why this shortage has come about and what is and can be done to remedy the situation. Various maps and charts in the booklet point up salient points of the discussion.

•

Swagelok Tube Fittings. (Catalog No. B-151). Crawford Fitting Co., 884 East 140th Street, Cleveland 10, Ohio. 8½ x 10¾ in. 12 pp.

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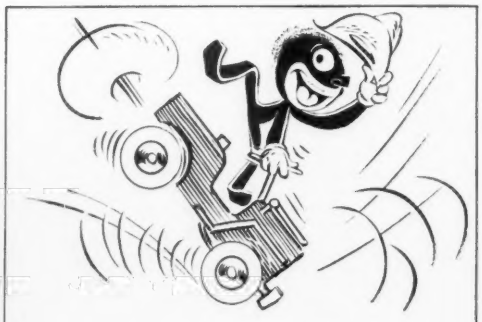
The complete line of Swagelok tube fittings are described in this catalog. Available in brass, aluminum, steel, stainless steel, and Monel, these fittings are said to be leakproof. Complete dimensional information, cross section drawings, installation recommendations and assembly instructions are included.



Roads Rough?
SEE PAGE 144

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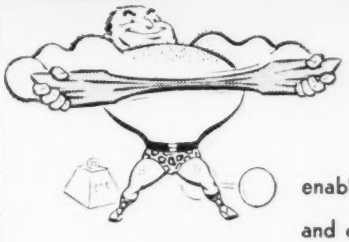

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To promote the profession and practice of Rubber Technology.

To encourage the extension of scientific and technical education in the principles and details of rubber manufacture.

To maintain a scheme of Diplomas for the recognition of efficiency in knowledge of all branches of technology essential to the successful maintenance and development of rubber manufacture.

To arrange for the holding of meetings, the reading of papers and the giving of lectures with subsequent discussions and publication.

To foster the systematic study of scientific and technical problems involved in the various phases of the manufacture of natural and synthetic rubbers and rubber-like materials and their conversion into finished products.

To encourage original work and research dealing with the manufacture of rubbers.

PUBLICATIONS.

The Transactions: Bi-monthly record of scientific and technological investigations in the realm of rubber and its allied industries.

Annual Report on the Progress of Rubber Technology: containing systematic accounts of the developments in rubber technology from year to year.

Proceedings of Rubber Technology Conferences.

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At this time of progress and expansion in the affairs of the Institution, its Council, conscious of the benefits that lie within the sphere of the Institution, invites applications for the privilege of membership from those engaged or interested in the Rubber and its allied industries.

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REVIEWS (CONT'D)

Plate Fabrication. Colonial Iron Works Co., 17631 St. Clair Ave., Cleveland 10, Ohio. 8¼ x 11 in. 8 pp.

The engineering and fabricating facilities of the company for a wide variety of tanks, kettles, towers, reactors and similar equipment are described and illustrated in this bulletin. Photographs show numerous views of fabricating operations, machinery and completed products. The bulletin also describes facilities for shearing, forming, fitting and welding to meet A.S.M.E. and A.P.I.-A.S.M.E. codes. Plant layout drawings show flow in of structural and plate parts and flow out of completed units. Tables and charts are used to outline the maximum dimensions which the company can handle and also the range of plate thicknesses in various alloys along with test pressures available for air and hydrostatic checks. The wide range of stainless and alloy steel and other metals that the company is accustomed to using is detailed in yet another chart. Also outlined are three ways in which Colonial Iron can assist with materials selection and basic design engineering.

•

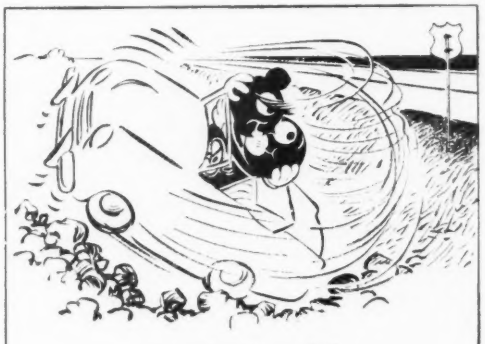
Pyrometer Supplies. (Buyers' Guide No. 100-4). Brown Instruments Division, Minneapolis-Honeywell Regulator Co., Wayne and Windram Aves., Philadelphia 44, Penna. 8½ x 11 in. 44 pp.

This catalog furnishes much useful technical information on the application and use of thermocouple pyrometric supplies. The catalog includes a complete line together with basic prices of all Brown standard thermocouple assemblies including base metal elements and Noble metal elements of all gauges. Information is given as to ordering procedure for various complete assemblies as well as the extension wire, terminal heads and blocks, primary and secondary protecting tubes, insulated charts, ink, insulated thermocouple wire and other pertinent information. Exploded views of all assemblies plus special molten metal, pencil type and midget thermocouples are included.

•

Keystone Planned Lubrication. (Bulletin BK-19). Keystone Lubricating Co., 21st. Clearfield & Lippincott Street, Philadelphia 32, Penna. 8½ x 11 in. 20 pp.

This bulletin gives details on seven Keystone specialized lubricants that cover a majority of plant requirements with a minimum of different types and densities. Information presented includes lubricant characteristics, benefits, uses, densities, specifications and container sizes. Products covered are lubricants for ball and roller bearings, plain and ring bearings, open gears, enclosed gears, speed reducers, and oils for cleaning, loosening and penetrating. The bulletin is illustrated with photographs and drawings.



Roads Rough?

SEE PAGE 144

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MARKETS

Rubber – Crude, Reclaimed and Scrap – Cotton – Ducks – Tire Fabrics – Sheetings

NEW YORK, NOV. 7, 1951

Natural Rubber

There have been rumors in the trade that GSA is interested in contracting for the purchase of Malayan rubber in an arrangement similar to the one concluded with Indonesia some months ago. The prospective contract would run through 1952 at a fixed price. While some industry leaders are opposed to government purchases at fixed prices, others would be pleased seeing in the plan an opportunity for the government to complete the projected stockpile. The sooner the stockpile is completed, they say, the sooner the government will get out of the rubber business.

As the government buying price, on the basis of No. 1 Ribbed Smoked Sheets, is still 48c landed, it is likely that a price near that figure will prove sufficiently attractive to estates to make commitments for a fair portion of 1952 production.

According to reports from Kuala Lumpur, rubber exports from Malaya during September declined nearly 15,000 tons from the previous month. The official figures show the drop was from 62,011 long tons in August to 47,191 in September. The main reason for the decline was that Great Britain took only 13,221 long tons in September compared with 17,417 tons in August, and that United States imports from Malaya fell to the lowest figure for many years—4,233 tons. The United States import for August was 8,314 tons. Earlier this year, however, it was well over 10,000 tons a month. Malayan production figures showed a decrease during September of 4,907 long tons, mainly due to a drop in output from small holders.

Quotations for the markets in London and Singapore, follow:

London Market

(Standard Smoked Sheets)

December	52.79 - 53.37
January-March	52.21 - 52.79

Singapore Market

(Standard Smoked Sheets)

December	50.42 - 50.60

Domestic Natural Rubber Prices

Grade	Price (per lb.)
Ribbed Smoked Sheets—No. 1	52c
No. 2	51¼
No. 3	50½
No. 4	48½
No. 5	44
Thin Latex—No. IX	60
No. 1	59
No. 2	56
No. 3	53
Thick Latex—No. IX	60
No. 1	59
No. 2	56
No. 3	53
Thin Brown—No. IX	47
No. 2X	44½
No. 3X	40
No. 1	42
No. 2	41
No. 3	40
No. 4	38
Blanket (Amber)—No. 2	42
No. 3	41
No. 4	40
Smoked Blanket—No. 1	42
No. 2	40
Flat Bark	34
Beni Bolivian Para	45
Upriver Fine Para	43
Liquid Latex	64

Note: These are General Services Administration Prices (plus service charges) for delivery ex G.S.A. shipping points.

Scrap Rubber

Activity in the scrap rubber market has been limited during the period despite an easing of prices below official ceilings. Demand from reclaimers was small, due in part to large mill inventories. The export market for scrap rubber was also depressed somewhat as a result of the dollar shortage abroad. This was particularly true in the case of Japan, normally a large importer of scrap. OPS-set prices for scrap rubber follow:

(Prices Delivered Akron)

Mixed tires	ton	$26.00
Mixed headless tires	ton	34.00
Light colored carcass	ton	130.00
Black carcass	ton	50.00
No. 1 peelings	ton	65.00
No. 2 peelings	ton	42.00
No. 3 peelings	ton	38.00
Buffings	ton	30.00
Truck and Bus S.A.G.	ton	28.00
Passenger S.A.G.	ton	28.00
Mixed S.A.G.	ton	26.00
Light colored tubes	lb.	.16
Natural rubber red tubes	lb.	.16
Natural rubber black tubes	lb.	.11½
Mixed natural rubber tubes	lb.	.10
Butyl rubber tubes	lb.	.057
GR-S rubber tubes	lb.	.02
Mixed synthetic tubes	lb.	.03

Reclaimed Rubber

Latest figures by the Department of Commerce indicate that during the first nine months of 1951, a total of 272,213 tons of reclaimed rubber were consumed. This compares with the 210,000 tons of reclaimed rubber consumed in the first nine months of 1950. Estimates by the Department indicate that 26,615 tons of reclaim were consumed in September, 1951, against the 28,598 tons consumed in the previous month. OPS-established prices for reclaimed rubber follow:

(Prices for All Areas Except Calif.)

Premium Grade Whole Tire	.10½
First Line Whole Tire	.10
Second Line Whole Tire	.09½
Third Line Whole Tire	.09¼
Fourth Line Whole Tire	.08¾
Black Carcass	.14½
No. 1 Light Colored Carcass	.20¾
No. 1 Select Peel	.11¾
No. 1 Peel	.10½
Butyl Tube Reclaim	.14½
S.P. Natural Rubber Black Tube	.21
Natural Rubber Black Tube	.20
Natural Rubber Red Tube	.24¼
Natural Rubber Gray Tube	.24¼

Cotton Tire Fabrics

According to the Department of Commerce, cotton tire cords and fabrics produced in the second quarter of 1951 totaled 70,107,000 pounds as opposed to the 65,889,000 pounds produced in the first quarter. Trade sources report a moderate quickening of activity in the cotton tire fabric market. The following quotations hold in the current market picture:

Standard, Peeler, 12/4/2	lb.	.85
Extra Staple, Peeler, 12/4/2	lb.	.92

Chafers

14.4 oz. (per sq. yard)	lb.	.77½
9.25 oz. (per sq. yard)	lb.	.74
11.65 oz. (per sq. yard)	lb.	.71
8.9 oz. (per sq. yard)	lb.	.75½

Cotton

The price of middling uplands on the New York Cotton Exchange has swung in a range of 3.25c since our last report (October 5), high for the period being 40.75c reached on November 7, and low being 37.50c reached on October 6. The average price of middling uplands for the month of October was 38.13c based on 26 trading days. This compares with an average of 36.20c in September.

The advance in cotton prices is forcing cotton mills to curtail their operations, trade sources indicate. Faced with the unusual and difficult situation of steadily mounting cotton costs on one hand, and a listless demand on the other, cotton gray goods sources predict that more weavers will have to cut production in the days immediately ahead. There has also been talk about higher wage demands coming out of the South.

Despite high cotton production this year, the carry-over in 1952 will be one of the smallest in the last 20 years, the Department of Agriculture said recently. The Department estimated the carry-over next August at about 3,000,000 bales, and foresees a use of 16,000,000 to 16,500,000 bales. Domestic mills are expected to use 10,000,000 to 10,500,000 bales, and exports are expected to reach 6,000,000 bales.

World cotton production has been tentatively estimated at 35,300,000 bales of 500 pounds gross in 1951-52. This is 28% higher than the revised estimate of 27,540,000 bales for 1950-51. World consumption, according to the International Cotton Advisory Committee, may not reach last season's 33,000,000 bales, but there should not be any appreciable decline.

Quotations for middling uplands on the Exchange follow:

	Oct. 5	November 7		
	Close	High	Low	Close
Dec.	36.76	39.95	39.40	39.90
Mar.	36.75	39.74	39.25	39.72
May	36.80	39.50	38.90	39.50

Synthetic Rubber

(Dry Types—Per Pound)

Butaprene NF	.465 - .475
Butaprene NL	.475 - .485
Butaprene NAA	.515 - .525
Butaprene NXM	.550 - .560
Chemigum 30N4NS	.400 - .470
Chemigum 50N4NS	.400 - .470
Chemigum N3	.450 - .520
G-E Silicone Rubber (compounded)	3.20 - 4.40
G-E Silicone Gum (not compounded)	—— - .600
GR-I	—— - .2075
GR-S	—— - .260
Hycar OR-25	.450 - .460
Hycar OR-15	.520 - .530
Hycar OS-10	.500 - .510
Neoprene Types CG and AC	—— - .500
Neoprene Type E	—— - .650
Neoprene Types FR and KNR	—— - .800
Neoprene Type GN	—— - .380
Neoprene Type GN-A	—— - .380
Neoprene Type RT	—— - .400
Neoprene Type S	—— - .380
Neoprene Type W	—— - .400
Paracril B	.500 - .510
Paracril BJ	.500 - .510
Paracril C	.580 - .590
Silastic (compounded)	2.35 - 4.40
Thiokol Type A	—— - .470
Thiokol Type FA	—— - .640
Thiokol PR-1	—— - .950
Thiokol Type ST	—— - 1.000

Rubber

natural

synthetic

SJP

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SAMPLES ON REQUEST

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This hydrocarbon plasticizer *completely* replaces dibutyl phthalate in nitrile rubbers—produces soft vulcanizates having high tensile, excellent elongation, and very low modulus. **PANAFLEX BN-1** plasticized stocks possess good ageing properties, superior electrical characteristics, and show good gasoline and oil resistance.

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STATISTICS *Of Interest to the Rubber Industry*

U. S. Imports and Re-Exports of Natural Rubber

	GROSS IMPORTS									RE-EXPORTS		TOTAL NET IMPORTS
	Natural Rubber (Dry)			Natural Rubber (Latex)			Guayule					
Year	Long Tons	Total Declared Value	Average Declared Value per pound Cents	Long Tons	Total Declared Value	Average Declared Value per pound Cents	Long Tons	Total Declared Value	Average Declared Value per pound Cents	Total Gross Imports Long Tons	Long Tons	Total Declared Value	Long Tons
1936	467,064	152,072,496	14.54	19,852	6,659,899	14.98	1,229	286,552	10.41	488,145	12,581	4,488,223	475,564
1937	574,600	237,307,041	18.44	23,185	10,213,670	19.67	2,694	745,873	12.36	600,479	7,902	3,385,433	592,577
1938	397,640	125,373,864	14.08	11,944	4,168,127	15.58	2,508	628,886	11.19	412,092	5,652	1,799,124	406,440
1939	469,936	167,586,780	15.92	27,437*	10,467,552	17.03	2,233	463,345	9.27	499,616	13,125	5,832,618	486,491
1940	781,202	303,308,823	17.33	33,789	14,593,466	19.28	3,633*	758,007	9.31	818,624	7,060	3,197,136	811,564
1941	989,498	401,976,317	18.14	34,797*	15,965,627	20.48	4,881	1,145,767	10.48	1,029,176	5,376	2,757,872	1,023,800
1942	266,276	112,537,426	18.87	10,646	5,630,667	23.61	5,523	1,660,792	13.42	282,445	10,856	5,913,386	271,589
1943	50,358	31,369,198	27.81	1,890	1,312,202	31.00	7,678*	3,636,789	21.14	59,926	22,583	16,446,707	37,343
1944	103,847	73,908,349	31.77	3,091	2,092,211	30.99	6,701*	3,351,233	22.33	113,639	9,739	8,712,695	103,900
1945	134,408	95,814,102	31.82	4,733	3,115,853	30.22	10,040	5,963,797	26.52	149,221	9,509	7,201,746	139,712
1946	366,415	232,552,939	27.12	8,421	5,843,085	29.14	5,344	2,859,246	23.89	380,180	7,711	5,331,954	372,469
1947	691,087	306,951,814	19.83	17,542	9,787,722	30.98	2,884	1,492,825	23.11	711,513	4,121	2,354,494	707,392
1948	702,293	290,849,177	18.49	32,745	9,820,080	24.93	302	71,330	10.53	735,340	6,672	3,259,324	728,668
1949	630,818	225,341,459	15.95	29,974	14,970,478	22.30	....	.....	....	660,792	6,253	2,746,109	654,539
1950	751,966	418,794,962	24.85	51,627	39,717,410	34.34	740	254,331	14.54	803,593	8,640	6,832,821	794,953
1950:													
May	56,804	21,822,118	17.15	3,183	1,904,513	26.71	200	58,948	13.16	60,187	597	289,551	59,590
June	73,806	31,525,162	19.07	3,965	2,294,158	25.83	105	33,651	14.31	77,876	625	322,008	76,451
July	53,245	27,256,854	20.11	4,225	2,710,430	28.64	70	26,836	17.11	57,540	683	381,650	56,857
Aug.	67,415	36,092,742	23.90	5,253	3,721,184	31.62	35	9,671	12.34	72,703	1,005	914,279	71,698
Sept.	55,981	36,724,072	29.23	5,117	4,369,707	38.12	55	15,148	12.34	61,153	879	798,935	60,274
Oct.	73,205	53,151,003	32.41	5,161	5,485,816	47.46	10	7,496	33.18	78,376	564	500,623	77,812
Nov.	68,462	62,121,636	40.51	4,456	6,227,022	56.71	29	21,618	33.46	72,947	604	724,050	72,343
Dec.	65,282	66,092,508	45.11	3,954	5,191,321	58.62	25	24,864	44.40	69,236	1,400	1,757,047	67,836
1951:													
Jan.	84,864	90,707,863	47.72	7,502	10,283,208	61.18	88	84,977	43.01	93,366	819	1,150,246	92,547
Feb.	49,217	55,013,580	49.90	5,347	8,314,086	64.91	123	119,086	43.27	54,687	552	790,245	54,135
Mar.	55,574	63,104,361	56.92	7,379	11,140,554	67.40	100	100,048	44.61	62,553	322	449,703	62,231
Apr.	48,931	55,238,582	50.31	5,850	9,604,002	73.29	182	183,311	44.93	54,963	3	3,942	54,960
May	37,737	44,187,969	52.27	4,534	7,584,613	74.67	99	80,285	36.16	42,370	7	11,132	42,363
June	51,811	61,809,219	53.26	4,692	7,475,970	71.13	120	84,110	30.14	56,623	224	423,689	56,399
July	67,511	78,807,699	52.11	5,619	8,522,995	67.71	154	99,482	28.82	73,284	.....	.....	73,284

* Adjusted to agree with total gross imports.

Source: U. S. Department of Commerce.

Notes: (1) Figures for latex are on a dry weight basis. (2) Figures for re-exports include natural rubber (dry and latex) and guayule. (3) In the years 1940 through 1943, crepe sole rubber imports were reported under a separate classification. Such imports, which are included under natural rubber, dry above, were: 856,294 pounds, valued at $191,097 in 1940; 379,607 pounds, valued at $85,924 in 1941; 662,503 pounds, valued at $159,530 in 1942; and 21,653 pounds, valued at $5,215 in 1943.

Natural Rubber
(Including Latex and Guayule)

(All Quantities in Long Tons)

Year	New Supply	Consumption	Re-Exports	Stocks On Hand at End of Period
1936	**488,145**	**575,000**	**12,581**	**223,000**
1937	**600,479**	**543,600**	**7,902**	**262,204**
1938	**411,983**	**437,031**	**5,652**	**231,500**
1939	**499,473**	**592,000**	**13,125**	**125,800**
1940	**818,243**	**648,500**	**7,060**	**288,864**
1941	**1,029,007**	**775,000**	**5,376**	**533,344**
1942	**282,653**	**376,791**	**10,856**	**422,714**
1943	**55,329**	**317,634**	**20,815**	**139,594**
1944	**107,834**	**144,113**	**9,665**	**93,650**
1945	**135,672**	**105,429**	**6,743**	**118,715**
1946	**400,687**	**277,597**	**4,338**	**237,467**
1947	**688,354**	**562,661**	**4,101**	**129,038**
1948	**735,227**	**627,332**	**6,673**	**141,541**
1949	**660,792**	**574,522**	**6,253**	**106,619**
1950	**804,143**	**720,268**	**8,644**	**91,434**
1950:				
June	77,876	63,333	625	99,457
July	61,660	61,402	683	93,653
Aug.	72,973	64,297	1,005	87,146
Sept.	61,148	61,281	879	87,409
Oct.	78,376	69,178	564	83,215
Nov.	73,493	51,340	604	81,658
Dec.	67,895	44,999	1,400	91,434
1951:				
Jan.	92,454	44,586	819	93,079
Feb.	54,564	37,572	552	87,242
Mar.	62,904	35,335	332	76,312
Apr.	54,781	39,508	185	71,629
May	42,271	42,445	151	68,498
June	56,504	39,998	224	68,369
July	73,180	35,478	...	67,816
Aug.	77,338	36,506	158	67,491
Sept.	61,944	37,086	391	57,427

Source: 1936-40, U. S. Department of Commerce; 1941 to date, Rubber Division, OMD, and Predecessor Agencies.

U.S. Gross Imports of Balata, Jelutong, Gutta-Percha, etc.

(All Quantities in Long Tons)

	Balata		Jelutong		Gutta-Percha & Other Guttas	
Year	Tons	Value	Tons	Value	Tons	Value
1936	535	199,368	6,163	1,296,364	1,568	555,643
1937	354	151,344	7,109	2,017,786	1,122	440,894
1938	509	181,140	9,132	2,944,504	444	204,582
1939	694	265,553	6,640	1,603,418	1,740	539,255
1940	648	300,500	7,451	2,449,137	2,340	1,004,885
1941	924	489,514	8,821	2,934,001	1,783	607,025
1942	1,544	1,107,059	1,290	530,296	804	525,763
1943	1,047	708,701	35	14,840	....	.....
1944	1,012	660,805	88	45,578	10	4,999
1945	1,361	907,253	....	.....	36	21,970
1946	2,281	2,233,065	304	256,169	423	458,064
1947	1,982	2,276,531	2,878	1,496,887	392	779,591
1948	1,195	805,078	3,401	2,377,765	423	542,788
1949	1,391	814,554	1,043	834,978	197	189,021
1950	2,117	1,589,885	1,789	1,515,162	541	745,418
1950:						
Mar.	90	66,374	113	97,008	17	13,672
Apr.	68	45,844	246	211,744	30	23,369
May	78	50,093	114	103,796	69	86,151
June	143	74,936	120	104,123	49	112,902
July	109	53,480	118	101,258	64	87,284
Aug.	171	103,985	234	200,912	46	41,790
Sept.	119	102,475	175	146,493	37	59,004
Oct.	372	311,959	174	132,632	64	146,707
Nov.	735	588,135	214	183,907	51	102,599
Dec.	124	126,709	82	91,411	28	16,361
1951:						
Jan.	242	200,534	184	227,244	108	118,988
Feb.	86	76,034	128	214,303	12	11,014
Mar.	30	22,838	192	222,934	33	65,143
Apr.	364	241,725	86	180,518	43	39,402
May	306	200,459	130	194,904	26	22,515
June	227	153,222	151	250,828	72	63,998
July	115	94,073	193	308,222	23	32,106

Source: U. S. Department of Commerce.

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Synthetic Rubber—Totals

(GR-S, Neoprene, Butyl, and Buna N Types)

(All Quantities in Long Tons)

Year	Production	Imports	Consumption	Exports	Stocks On Hand at End of Period
1941	8,383	.....	6,259	572	1,702
1942	31,451	.....	17,551	1,419	4,612
1943	231,722	.....	170,891	18,148	41,568
1944	762,630	11,043	566,670	104,266	142,927
1945	820,375	10,407	693,580	83,778	203,454
1946	740,026	2,709	761,699*	72,920	114,963
1947	508,702	5,043	559,566	11,385	62,366
1948	488,343	15,671	442,072	4,874	115,111
1949	393,690	12,242	390,853	6,483	98,042
1950	476,184	23,722	538,289	7,652	52,758
1951:					
Feb.	36,435	1,267	33,308	615	59,035
Mar.	45,286	1,152	65,587	526	60,614
Apr.	40,434	1,148	58,267	554	65,793
May	39,541	518	65,027	596	79,276
June	34,188	445	64,718	534	78,154
July	36,250	815	61,419	966	86,527
Aug.	24,951	650	67,260	771	96,382
Sept.	20,870	525	69,160	610	100,792

Source: Rubber Division, OMD, and Predecessor Agencies.

Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (2) Figures shown include the output of both government and privately-owned plants. (3) Figures for 1941 are estimated. * Includes year-end adjustment of 5,384 tons to cover non-reporting companies.

Synthetic Rubber—By Type

(All Quantities in Long Tons)

New Supply

	GR-S (Buna S)	GR-M (Neoprene)	GR-I (Butyl)	Buna N Types	Total
1943	182,259	33,603	1,373	14,487	231,722
1944	679,949	56,660	20,252	16,812	773,673
1945	724,859	45,672	52,378	7,871	830,780
1946	613,408	47,766	80,823	5,738	747,735
1947	408,858	31,495	62,824	6,618	509,795
1948	405,442	34,848	56,662	7,012	504,014
1949	310,598	35,215	54,046	11,072	410,932
1950	378,887	50,067	60,915	12,037	501,906

Consumption

1943	131,977	26,205	304	12,405	170,891
1944	495,552	46,243	10,763	14,112	566,670
1945	600,145	42,994	43,072	8,079	693,580
1946	632,126	44,357	79,228	5,988	761,699
1947	448,589	37,703	68,838	4,536	559,666
1948	345,313	32,118	58,870	5,771	430,618
1949	299,420	31,753	50,855	8,827	397,139
1950	416,230	43,781	66,348	11,930	538,289

Exports

1943	14,937	2,540	40	631	18,148
1944	98,380	4,799	530	557	104,266
1945	76,555	5,837	980	406	83,778
1946	68,763	2,642	495	797	72,697
1947	7,951	2,617	62	755	11,385
1948	1,093	2,875	21	885	4,874
1949	1,401	3,330	128	1,574	6,483
1950	900	4,826	31	1,895	7,652

Stocks at End of Period

1943	30,975	6,415	1,033	3,145	41,568
1944	116,130	11,274	9,992	5,166	142,927
1945	170,571	9,703	18,378	4,802	203,454
1946	81,483	10,470	19,478	3,755	115,186
1947	40,606	5,237	13,184	3,339	62,366
1948	96,282	5,072	10,995	2,762	115,111
1949	77,731	4,654	12,224	3,433	98,042
1950	36,942	5,733	7,243	2,840	52,758

Source: Rubber Division, OMD, and Predecessor Agencies.

Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (2) Figures for GR-M and Buna N Types include production of privately-owned plants.

Gasoline Consumption

(In Thousands of Barrels of 42 Gallons)

	1944	1945	1946	1947	1948	1949	1950	1951
Jan.	47,540	52,008	51,746	57,057	61,308	63,125	66,908	80,554
Feb.	47,754	48,856	47,654	50,581	56,487	57,980	63,366	72,717
Mar.	52,263	55,761	56,037	59,947	68,171	73,282	78,739	86,486
Apr.	50,005	59,024	62,111	64,140	72,183	75,318	80,348	87,430
May	54,230	60,748	66,800	70,865	77,186	81,665	89,033	100,188
June	54,266	60,580	63,247	71,329	78,044	83,374	90,010	96,093
July	55,119	66,170	60,076	73,441	81,428	82,129	91,707	100,476
Aug.	55,618	70,058	66,729	72,089	80,351	84,707	94,537	101,206
Sept.	56,318	64,529	62,268	71,384	76,159	80,832	86,766	.....
Oct.	53,154	55,748	56,637	73,277	75,164	79,327	89,126	.....
Nov.	51,967	53,543	61,345	64,158	72,560	76,346	82,718	.....
Dec.	52,250	49,743	61,101	67,506	72,162	75,628	80,994	.....
Total	633,482	696,333	735,417	795,015	871,270	913,713	994,412	.....

Source: U. S. Bureau of Mines.

Reclaimed Rubber

(Including Natural and Synthetic)

(All Quantities in Long Tons)

Year	Production	Consumption: Tons	Consumption: % to Crude [a]	Exports	Stocks On Hand at End of Period
1936	150,571	141,486	24.6	7,085	19,000
1937	185,033	162,000	22.8	13,253	28,800
1938	122,400	120,800	27.6	7,403	23,000
1939	186,000	170,000	28.2	12,611	25,250
1940	208,971	190,244	29.3	11,847	32,636
1941	274,202	251,231	32.2	13,851	41,750
1942	286,007 [b]	254,820	64.6	30,405	42,532
1943	304,058 [c]	291,082	59.6	15,678	46,201
1944	260,631 [d]	251,085	35.3	11,800	43,832
1945	243,309	241,036	30.2	13,413	28,155
1946	295,612	275,410	26.5	14,461	33,666
1947	291,595	288,395	24.8	14,556	35,943
1948	266,861	261,113	24.4	11,428	32,630
1949	224,029	226,679	22.5	10,637	28,263
1950	314,008	303,733	24.1	11,740	35,708
1950:					
Dec.	32,652	29,905	30.4	1,241	35,708
1951:					
Jan.	33,044	32,455	31.0	1,336	35,543
Feb.	30,502	28,792	31.7	1,629	36,885
Mar.	35,294	32,678	32.4	1,475	38,334
Apr.	34,311	32,428	33.0	1,398	39,064
May	35,078	34,148	31.8	1,512	39,098
June	31,529	30,999	29.5	1,416	40,268
July	29,999	25,500	26.3	1,017	44,347
Aug.	29,175	28,598	27.5	991	43,900
Sept.	26,863	26,615	25.0	1,347	43,658

Source: 1936-40, Department of Commerce; 1941 to date, Rubber Division, OMD, and Predecessor Agencies.

Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (a) Includes natural and synthetic rubber. (b) Includes 893 tons of imports. (c) Includes 67 tons of imports. (d) Includes 21 tons of imports.

Automobile Production in U. S.

(Civilian Production Only)

Year	Passenger Cars	Trucks	Total	Year	Passenger Cars	Trucks	Total
1931	1,973,090	416,648	2,389,738	1941	3,744,500	875,381	4,619,681
1932	1,135,491	235,187	1,370,678	1942	220,814	133,043	353,857
1933	1,573,512	346,545	1,920,057	1943	0	4,501	4,501
1934	2,177,919	575,192	2,753,111	1944	0	124,819	124,819
1935	3,252,244	694,690	3,946,934	1945	83,792	313,643	397,435
1936	3,669,528	781,862	4,451,390	1946	2,148,699	930,760	3,079,459
1937	3,915,889	892,382	4,808,271	1947	3,558,178	1,220,634	4,778,812
1938	2,000,985	485,852	2,486,837	1948	3,909,270	1,363,856	5,273,126
1939	2,866,796	704,308	3,571,104	1949	5,108,841	1,123,736	6,232,577
1940	3,692,428	721,637	4,413,965	1950	6,665,836	1,332,263	7,998,099
1950:							
Jan.	487,824	93,323	581,147	July	595,067	111,028	706,095
Feb.	385,361	89,971	475,332	Aug.	682,782	134,853	817,635
Mar.	469,618	110,843	580,461	Sept.	616,827	105,562	722,389
Apr.	455,193	103,850	559,043	Oct.	651,169	108,815	723,984
May	575,518	120,963	696,481	Nov.	504,445	98,538	602,983
June	720,688	135,332	856,020	Dec.	521,371	118,890	640,261
1951:							
Jan.	478,589	127,583	606,172	July	381,407	110,244	481,651
Feb.	505,865	111,935	617,800	Aug.	426,932	121,993	548,925
Mar.	617,399	136,794	754,193	Sept.	365,906	109,353	475,259
Apr.	503,038	135,415	638,453	Oct.	.....	.....	.....
May	511,938	140,047	651,985	Nov.	.....	.....	.....
June	482,029	134,818	616,847	Dec.	.....	.....	.....

Source: Automobile Manufacturers Association.

Note: Figures are based on factory sales. Revisions are made from time to time in these figures and the latest issue should be consulted for accuracy.

Rim Production

	1946	1947	1948	1949	1950
Passenger Car	15,058,469	21,346,004	23,842,796	27,715,344	35,096,404
Truck & Bus	5,939,244	7,737,353	6,920,231	4,238,174	6,625,129
Agricultural	1,735,992	2,633,699	3,140,882	2,695,430	2,853,483
Earth Mover	5,520	10,610	13,330	9,895	15,602
Total	22,739,225	31,727,666	33,917,239	34,658,843	44,590,618

	1951					
	Apr.	May	June	July	Aug.	Sept.
Passenger Car	2,930,710	2,645,443	2,131,958	2,158,601	2,173,477	2,261,654
Truck & Bus	658,581	642,612	548,424	571,161	524,071	489,569
Agricultural	283,561	244,342	232,354	238,983	231,629	228,550
Earth Mover	2,073	1,138	1,418	2,470	2,901	2,309
Total	3,874,925	3,533,535	2,914,154	2,971,215	2,932,078	2,982,082

Source: The Tire & Rim Association, Inc.

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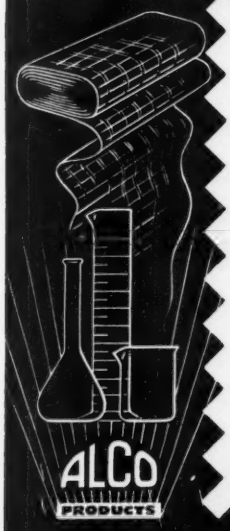

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	Shipments: Original Equipment	Shipments: Replacement	Shipments: Export	Shipments: Total	Production	Inventory End of Period
1938 (total)	11,516	30,567	1,049	43,132	40,907	8,451
Passenger Car	10,086	27,104	580	37,770	35,789	6,937
Truck and Bus	1,430	3,463	469	5,362	5,118	1,514
1939 (total)	18,208	38,022	1,279	57,509	57,613	8,665
Passenger Car	15,742	33,471	607	49,820	49,933	7,108
Truck and Bus	2,466	4,551	672	7,689	7,680	1,557
1940 (total)	22,252	35,346	1,176	58,774	59,186	9,127
Passenger Car	19,560	30,903	411	50,874	50,965	7,270
Truck and Bus	2,692	4,443	765	7,900	8,221	1,857
1941 (total)	24,780	39,895	1,489	66,164	61,540	4,436
Passenger Car	19,855	34,119	586	54,560	50,392	3,165
Truck and Bus	4,925	5,776	903	11,604	11,148	1,271
1942 (total)	6,680	8,872	207	15,759	15,351	6,247
Passenger Car	910	2,734	38	3,682	2,790	4,432
Truck and Bus	5,770	6,138	169	12,077	12,561	1,815
1943 (total)	6,128	18,547	225	24,900	20,423	1,883
Passenger Car	82	10,606	71	10,759	7,620	1,132
Truck and Bus	6,046	7,941	154	14,141	12,803	751
1944 (total)	6,654	26,439	263	33,356	33,446	2,013
Passenger Car	208	18,330	130	18,668	18,819	1,218
Truck and Bus	6,446	8,109	133	14,688	14,627	795
1945 (total)	5,984	36,479	504	42,967	44,524	3,077
Passenger Car	1,115	25,463	222	26,800	28,200	2,214
Truck and Bus	4,869	11,016	282	16,167	16,324	863
1946 (total)	15,310	65,490	1,512	82,312	82,298	2,448
Passenger Car	11,086	54,684	653	66,423	66,466	1,763
Truck and Bus	4,224	10,806	859	15,889	15,832	685
1947 (total)	25,056	62,871	3,256	91,183	95,550	6,949
Passenger Car	19,644	52,857	1,608	74,109	77,795	5,444
Truck and Bus	5,412	10,014	1,648	17,074	17,755	1,505
1948 (total)	**26,845**	**49,148**	**1,787**	**77,781**	**81,314**	**10,698**
Passenger Car	**21,589**	**41,295**	**656**	**63,540**	**66,738**	**8,773**
Truck and Bus	**5,256**	**7,853**	**1,132**	**14,241**	**14,576**	**1,925**
1949 (total)	31,584	43,466	1,467	76,517	76,369	10,638
Passenger Car	28,129	36,440	509	65,077	65,140	8,904
Truck and Bus	3,456	7,026	958	11,440	11,228	1,734
1950 (total)	41,349	56,808	1,430	99,587	92,754	3,794
Passenger Car	36,678	47,103	642	84,423	78,598	3,050
Truck and Bus	4,671	9,705	788	15,164	14,156	743
1951:						
June (total)	2,603	4,439	143	7,185	7,222	3,478
Passenger Car	2,099	3,513	80	5,691	5,672	2,493
Truck and Bus	504	926	64	1,499	1,550	985
July (total)	2,361	4,126	115	6,602	6,734	3,586
Passenger Car	1,915	3,248	54	5,217	5,278	2,539
Truck and Bus	446	878	61	1,385	1,455	1,047
Aug. (total)	2,811	4,230	120	7,162	7,549	4,033
Passenger Car	2,356	3,225	53	5,634	6,021	2,967
Truck and Bus	455	1,005	67	1,527	1,528	1,065

Source: The Rubber Manufacturers Association, Inc.

Cotton, Rayon and Nylon Tire Fabrics

(Production in Thousands of Pounds)

	Cotton: Tire Cord Not Woven	Cotton: Cord Fabric Woven	Cotton: Chafer and All Other Tire Fabrics	Cotton: Total	Rayon and Nylon[b]: Tire Cord Not Woven	Rayon and Nylon[b]: Tire Cord And Other Tire Fabrics	Rayon and Nylon[b]: Total
1948:							
Jan.-Mar.	18,546	50,251	19,391	88,188	*a*	60,569	60,569
Apr.-June	15,585	48,385	18,213	79,183	*a*	59,759	59,759
July-Sept.	29,743	45,927	*c*	75,670	*a*	63,642	63,642
Oct.-Dec.	13,321	34,424	15,879	63,624	*a*	65,258	65,258
Total	77,195	175,987	53,483	306,665	.....	249,228	249,228
1949:							
Jan.-Mar.	*d*	33,213	25,395	36,608	*a*	68,296	68,926
Apr.-June	5,309	29,114	13,617	48 040	*a*	68,269	68,269
July-Sept.	1,343	16,620	11,141	29,104	15,640	55,969	71,609
Oct.-Dec.	180	17,650	11,886	29,716	12,967	58,890	72,857
Total	6,832	96,597	62,039	163,468	28,607	251,424	281,661
1950:							
Jan.-Mar.	3,939	19,210	12,948	36,097	12,469	60,981	73,450
Apr.-June	11,077	29,498	14,071	54,646	11,510	59,966	71,476
July-Sept.	10,529	39,792	15,101	65,152	13,161	61,614	74,775
Oct.-Dec.	13,314	17,759	14,405	65,578	12,942	63,399	76,341
Total	38,859	126,259	56,525	221,473	50,082	245,960	296,476
1951:							
Jan.-Mar.	10,929	38,223	16,737	65,889	12,715	65,275	77,990
Apr.-June	11,303	41,479	17,055	70,107	12,810	62,143	74,953
July-Sept.	.....	.....	.....	.....	.....	.....	.....
Oct.-Dec.	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....

Source: U. S. Bureau of the Census.

Notes: (a) Included with tire cord and fabrics to avoid disclosures of operations of individual mills. (b) Fuel cell fabrics are not included with rayon and nylon tire cord and fabrics. (c) Included with tire cord not woven. (d) Included with chafer and all other tire fabrics.

Automotive Inner Tubes

(Thousands of Units)

	Shipments: Original Equipment	Shipments: Replacement	Shipments: Export	Shipments: Total	Production	Inventory End of Period
1938	11,515	28,134	644	40,293	37,848	8,166
1939	18,190	31,998	1,002	51,190	50,649	7,036
1940	22,172	29,070	972	52,214	52,237	7,017
1941	24,722	33,749	1,232	59,703	57,433	4,686
1942	6,895	7,213	159	14,267	12,685	6,206
1943	6,350	12,474	189	19,014	15,014	2,626
1944	6,460	20,569	196	27,224	27,488	2,813
1945	5,988	33,906	411	40,304	41,742	3,627
1946	15,327	59,357	1,424	76,108	77,251	3,820
1947	25,046	46,560	2,483	74,088	79,181	8,059
1948	26,833	40,548	1,119	68,499	70,033	9,641
1949	31,521	31,450	887	63,858	65,114	10,657
1950	41,240	42,671	811	84,723	80,179	.....
1951:						
May	2,692	2,823	70	5,585	5,625	5,071
June	2,597	2,828	68	5,493	5,374	5,294
July	2,362	2,637	73	5,072	5,178	5,685
Aug.	2,809	2,865	87	5,761	6,139	6,272

Source: The Rubber Manufacturers Association, Inc.

Smoked Sheets—Spot Closing Prices

(New York Market—Cents per pound)

Year	High	Low	Avg.	Year	High	Low	Avg.
1910	288	141	206.60	1931	8⅝	4⅛	6.17
1911	184	114	141.30	1932	4⅜	2½	3.49
1912	140	108	121.60	1933	9⅞	2⅛	5.96
1913	113	59	82.04	1934	15⅜	8⅛	12.92
1914	93	56	65.33	1935	13¾	10½	12.37
1915	79	58½	65.85	1936	23	13½	16.41
1916	102	55	72.50	1937	26⅞	14	19.39
1917	90	52	72.23	1938	17⅞	10¼	14.64
1918	70	40	60.15	1939	24	14⅛	17.57
1919	57	38½	48.70	1940	24	18⅛	20.10
1920	56½	16	36.30	1941	24⅜	19⅛	22.40
1921	21¼	11½	16.36	1942	22½	22½	22.50
1922	28⅛	13⅝	17.50	1943	22½	22½	22.50
1923	37½	24¼	29.45	1944	22½	22½	22.50
1924	40½	17⅜	26.20	1945	22½	22½	22.50
1925	121	34⅜	72.46	1946	22½	22½	22.50
1926	88½	36¾	48.50	1947	25	14	20.00
1927	41⅜	33	37.72	1948	25	18	21.99
1928	41¾	17	22.48	1949	19⅜	15⅞	17.57
1929	26½	15⅜	20.55	1950	86	18	41.10
1930	16⅝	7½	11.98				

Note: Price was fixed by Government on August 6, 1941, at 22½c a pound for non-war uses. Free trading was resumed May 1, 1947.

Spot Closing Cotton Prices

(Middling Upland Grade—New York Market—in Cents)

Average Monthly Price Per Pound

	1944	1945	1946	1947	1948	1949	1950	1951
Jan.	20.76	22.36	25.49	32.58	36.09	33.37	31.89	45.04
Feb.	21.34	22.29	26.57	33.91	33.63	33.41	32.79	(a)
Mar.	21.65	22.43	27.52	35.89	35.04	33.44	33.65	46.06
Apr.	21.71	21.88	28.40	35.89	38.10	33.84	33.23	46.06
May	21.63	23.30	28.17	36.51	38.57	33.73	33.64	46.06
June	23.31	23.42	29.89	37.83	38.12	33.56	34.61	46.06
July	22.33	23.27	34.11	38.03	34.89	32.99	38.11	41.21
Aug.	22.11	23.10	36.31	34.83	32.23	32.06	38.93	35.93
Sept.	22.10	23.25	37.59	32.21	31.92	30.94	41.62	36.20
Oct.	22.32	23.85	36.79	32.39	32.01	30.32	40.66	38.13
Nov.	22.13	24.71	31.50	34.50	32.15	30.52	43.11	.....
Dec.	22.28	25.21	33.03	36.74	32.90	31.08	43.37	.....
Average for Year	21.89	23.25	31.28	35.11	34.64	32.44	37.05	.....

Note: The Government established a ceiling price of 45.76c for spot cotton on March 3, 1951. (a) Trading suspended during February.

Consumption of Vinyl Resins

(In Thousands of Pounds)

	Sheeting and Film[a]	Textile and Paper Coating Resins[b]	Molding and Extrusion Materials[b]	All Other[b, c]
1946	52,080	11,673	61,852	27,083
1947	66,430	17,237	73,114	27,064
1948	98,021	31,085	73,598	21,147
1949	157,544	29,470	81,842	19,792
1950	227,149	46,044	113,889	21,868
1951:				
May	13,856	3,894	12,663	2,112
June	14,186	3,853	13,357	2,461
July	14,081	3,852	11,496	2,579
Aug.	12,519	4,034	11,874	2,384

Source: U. S. Tariff Commission.

Notes: (a) Includes weight of fillers, plasticizers, extenders and safety glass sheeting; (b) Resin content; (c) Includes Adhesives, but excludes data for protective coating resins. Beginning January, 1951, statistics are listed on a resin content basis.

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All Rubber Products

	1950				1951			
Mo.	Production Workers (thousands)	Average Weekly Earnings	Average Weekly Hours	Average Hourly Earnings	Production Workers (thousands)	Average Weekly Earnings	Average Weekly Hours	Average Hourly Earnings
Jan.	187	$60.52	39.4	$1.536	222	$66.78	40.4	$1.653
Feb.	188	59.90	39.2	1.528	222	63.37	38.9	1.629
Mar.	189	59.70	39.3	1.519	220	63.88	40.0	1.647
Apr.	191	61.76	40.0	1.544	219	65.96	40.0	1.649
May	194	64.52	41.2	1.566	220	68.56	41.3	1.660
June	199	65.08	41.4	1.572	221	71.74	42.4	1.692
July	200	65.59	41.2	1.592	218	71.56	41.7	1.716
Aug.	208	66.25	41.8	1.585	221	..	....	....
Sept.	213	66.58	41.9	1.589	....	....	....	....
Oct.	219	66.29	41.9	1.582	....	....	....	....
Nov.	222	66.52	41.5	1.603	....	....	....	....
Dec.	222	68.76	41.6	1.653	....	....	....	....

Tires and Tubes

Jan.	82.6	67.70	38.4	1.763	91.3	73.69	38.4	1.919
Feb.	83.1	67.22	38.3	1.755	90.6	66.95	35.5	1.886
Mar.	83.4	65.26	37.4	1.745	88.3	71.40	37.6	1.899
Apr.	84.0	69.23	39.0	1.775	87.4	70.15	37.0	1.896
May	85.9	74.60	41.1	1.815	88.3	75.92	39.4	1.927
June	88.0	74.05	40.6	1.824	89.8	83.09	41.9	1.983
July	88.3	75.22	40.4	1.862	90.3	85.13	42.1	2.022
Aug.	89.6	76.01	40.8	1.863	....	....	....	....
Sept.	91.7	75.46	40.9	1.845	....	....	....	....
Oct.	92.0	73.12	40.2	1.819	....	....	....	....
Nov.	93.4	73.20	40.1	1.838	....	....	....	....
Dec.	92.1	76.21	39.9	1.910	....	....	....	....

Rubber Footwear

Jan.	20.1	45.87	35.7	1.285	24.9	57.53	41.6	1.383
Feb.	18.8	43.06	34.2	1.259	25.3	55.87	40.6	1.376
Mar.	19.4	51.04	40.0	1.276	25.0	58.17	41.4	1.405
Apr.	19.3	50.36	39.5	1.275	24.8	59.82	42.1	1.421
May	19.1	50.20	39.4	1.274	25.4	61.48	42.9	1.433
June	19.3	52.07	40.3	1.292	25.7	60.11	42.3	1.421
July	19.2	52.13	39.7	1.313	24.8	54.97	38.9	1.413
Aug.	20.7	53.93	41.9	1.287	....	....	....	....
Sept.	21.8	53.95	41.5	1.300	....	....	....	....
Oct.	22.8	56.00	42.2	1.327	....	....	....	....
Nov.	23.2	54.52	42.0	1.298	....	....	....	....
Dec.	23.9	59.34	42.6	1.393	....	....	....	....

All Other Rubber Products

Jan.	84.5	57.04	41.3	1.381	105.8	63.06	41.9	1.505
Feb.	86.3	56.43	41.1	1.373	106.3	61.95	41.3	1.500
Mar.	86.2	56.16	40.9	1.373	106.3	63.13	41.7	1.514
Apr.	87.2	57.13	41.1	1.390	106.3	63.81	41.9	1.523
May	88.8	57.92	41.7	1.389	106.0	64.09	42.5	1.508
June	92.0	59.23	42.4	1.397	105.5	64.84	42.8	1.515
July	92.8	59.08	42.2	1.400	103.1	63.63	42.0	1.515
Aug.	98.0	60.13	42.8	1.405	....	....	....	....
Sept.	101.0	61.30	42.9	1.429	....	....	....	....
Oct.	104.1	62.48	43.3	1.443	....	....	....	....
Nov.	105.0	62.71	42.6	1.472	....	....	....	....
Dec.	105.7	64.29	42.8	1.502	....	....	....	....

Source: U. S. Department of Commerce and Labor.

Note: Data are based upon reports from cooperating establishments covering both full and part-time employees who worked during or received pay for the pay period ending nearest the 15th of the month. The employment series have been adjusted to levels indicated by Federal Security Agency data for 1947, and have been carried forward from 1947 bench-mark levels, thereby providing consistent series. Hours and earning data pertain only to production and related workers.

Production Index for the Rubber Industry

Production 1935-1939 = 100

(Based on man-hours)

	1949	1950	1951		1949	1950	1951
Jan.	191	194	244	July	175	222	249
Feb.	188	195	235	Aug.	178	236	253
Mar.	182	197	239	Sept.	174	244	....
Apr.	177	203	238	Oct.	192	250	....
May	178	213	247	Nov.	187	250	....
June	178	221	255	Dec.	193	251	....

Source: U. S. Department of Commerce.

Sales by the Rubber Industry

(In Millions of Dollars)

	1949	1950	1951		1949	1950	1951
Jan.	260	265	454	July	271	454	438
Feb.	251	273	434	Aug.	288	457	438
Mar.	260	293	459	Sept.	272	404	....
Apr.	257	288	439	Oct.	255	405	....
May	248	321	432	Nov.	247	397	....
June	266	350	433	Dec.	245	424	....

Source: U. S. Department of Commerce.

Rubber Manufacturers' Inventories

(Based upon Book-Value)

(In Millions of Dollars)

	1949	1950	1951		1949	1950	1951
Jan.	661	524	562	July	625	501	616
Feb.	661	526	555	Aug.	593	483	616
Mar.	653	532	554	Sept.	538	502	....
Apr.	648	536	565	Oct.	517	524	....
May	650	540	583	Nov.	526	564	....
June	644	544	610	Dec.	531	549	....

Source: U. S. Department of Commerce.

Various Compounding Materials Consumed by the Rubber Industry

Material	1944	1945	1946	1947	1948	1949	1950
Antimony, Primary:							
Short tons	.....	.....	.....	39	41	55	.....
% of total	....	.....	.....	.002	.003	.005	.....
Asphalt [a]							
Short tons	20,189	19,483	28,715	32,113	19,967	18,050	26,819
% of total	.006	.005	.007	.007	.004	.003	.003
Barite (Barytes):							
Short tons	10,000	10,000	20,000	17,000	18,000	14,000	.....
% of total	2.9	2.1	4.4	3.1	2.85	2.53	.....
Carbon Black:							
Short tons	369,015	402,193	470,732	471,790	435,282	383,565	515,184
% of total	94.6	95.5	95.3	94.3	95.5	93.3	92.9
Clay, Kaolin:							
Short tons	59,588	109,936	162,393	166,201	176,965	197,341	263,306
% of total	6.8	11.7	12.3	11.5	11.3	13.1	15.0
Clay, Fire & Stoneware:							
Short tons	7,160	7,800	12,951	17,970	15,480	.....	.....
% of total	0.1	0.1	0.2	0.2	0.2	....	.....
Lime:							
Short tons	5,634	7,170	3,193	589	1,154	715	.....
% of total	0.09	0.12	0.05	0.01	0.02	.0002	.....
Litharge:							
Short tons	3,023	1,864	2,131	2,205	2,835	.....	.....
% of total	2.2	1.3	1.6	1.3	1.8	.....	.....
Lithopone:							
Short tons	726	977	1,607	3,085	4,192	3,243	.....
% of total	0.5	0.7	1.1	1.9	3.0	4.1	.....
Mica, Ground:							
Short tons	1,137	3,715	4,951	3,900	4,372	3,856	.....
% of total	2.2	7.1	8.0	6.0	7.0	7.0	.....
Sulfur:							
Short tons	63,000	64,960	72,800	72,800	70,560	59,360	.....
% of total	1.9	2.0	2.2	1.8	1.7	1.5	.....
Talc [b]							
Short tons	51,833	63,758*	65,980	71,840	66,226	53,414	.....
% of total	13.0	16.0	14.4	13.9	13.0	.12	.....
Zinc Oxide:							
Short tons	59,518	63,447	83,776	82,248	82,895	.....	.....
% of total	42.3	49.6	53.1	51.2	54.9	.....	.....

Source: U. S. Bureau of Mines.

Notes: [a] Solid and semi-solid products of less than 200 penetration. [b] Includes prophyllite and ground soapstone. * Revised.

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1. The names and addresses of the publisher, editor, managing editor, and business manager are:

Publisher, Palmerton Publishing Company, Inc., 250 West 57th St., New York 19, N. Y.; Editor, M. E. Lerner, 250 West 57th St., New York 19, N. Y.; Managing Editor, None; Business Manager, Peter P. Pinto, 250 West 57th St., New York 19, N. Y.

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PETER P. PINTO, Business Manager.

Sworn to and subscribed before me this 25th day of September, 1951.

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INDEX TO ADVERTISERS

A

A-C Supply Co. — 187
Adamson United Co. 259
Adhesive Products Corp. 186
Advance Solvents & Chemical Corp. —
Akron Equipment Co. 274
Akron Rubber Machinery Co. 274
Albert, L., & Son 267
Alco Oil & Chemical Corp. 267
Aluminum Flake Co.
American Cyanamid Co.
Calco Chemical Div. 151
Industrial Chemicals Division 183
American Monomer Corp. 254
American Zinc Sales Co. 163
Ames, B. C., Company 251
Argus Chemical Laboratory 249
Armstrong Machine Works 244
Atlas Electric Devices Co. 250
Atlas Valve Co.

B

Bagley & Sewall Co. 246
Baird Rubber and Trading Co. —
Baker & Adamson Products, General Chemical Div., Allied Chemical & Dye Corp. —
Ball and Jewell, Inc. 253
Bardon Rubber Products Co. 274
Barrett Div., Allied Chemical & Dye Corp. —
Beacon Chemical Industries, Inc. 178
Bestread Products Co. 274
Binney & Smith Co. Insert Following 226
Black Rock Mfg. Co. —
Bolling, Stewart, & Company, Inc. —
Bonwitt, Eric —
Bridgwater Machine Co., Athens Machine Div. —
Brockton Cutting Die & Machine Co. —
Brooklyn Color Works, Inc. 267
Brown Company —

C

Cabot, Godfrey L., Inc. Insert Following 184
Cambridge Instrument Co. —
Cameron Machine Co. —
Carey, Phillip, Mfg. Co. —
Carter Bell Mfg. Co. 258
Chemical & Pigment Div., Glidden Co. —
Chemical Publishing Co. 271
CLASSIFIED ADVERTISING 272, 273, 274
Cleveland Liner & Mfg. Co. 146
Colledge, E. W., General Sales Agent, Inc. 257
Colonial Insulator Co. 251
Columbia-Southern Chemical Corp. —
Columbian Carbon Co. Insert Following 226
Concord Mica Corp. —
CONSULTANTS SECTION 271
Continental Carbon Co. Back Cover
Cooke Color & Chemical Co. —
Coulter, James, Machinery Co. —

D

Dewey and Almy Chemical Co. 255
Diamond Alkali Company
Pure Calcium Prod. Div. 148
Dow Corning Corp. 180
du Pont de Nemours, E. I., & Co., Inc.
Organic Chemicals Department —
Rubber Chemicals Div. Second Cover

E

Elm City Rubber Co. 273
Emerson Apparatus Co. 253
English Mica Co. 267
Erie Engine & Mfg. Co. 245

F

Farrel-Birmingham Co., Inc. 153
Fawick Airflex Co., Inc. —
Ferry Machine Co. 250
Elm City Rubber Co. 273

G

Gammeter, W. F., Co. 267
R. Gelb & Sons, Inc. 274
General Atlas Carbon Co. 155
General Chemical Division, Allied Chemical & Dye Corp. —
General Electric Co.
Apparatus Dept. —
Chemical Dept. —
General Latex & Chemical Corp. 261
General Magnesite & Magnesia Co. —
Genseke Brothers 165
Giuley, Philip Tucker —
Glidden Co., Chemical & Pigment Div. —
Goodrich, B. F., Chemical Co. (Chemical) —
Goodrich, B. F., Chemical Co. (Hycar) 143
Goodyear Tire & Rubber Co.
(Chemical Div.) 145, 149
Gummi und Asbest —

H

Hadley Bros.—Uhl Co. 252
Hall, C. P., Co. 156, 157
Hardesty Chemical Co., Inc. 154
Hardman, H. V., Co., Inc. 257
Harwick Standard Chemical Co. 243
Heresite & Chemical Co. —
Heveatex Corporation 269
Hoggson & Pettis Mfg. Co. —
Holliston Mills, Inc. 261
Holmes, Stanley H., Co. 242
Howe Machinery Co., Inc. 269
Huber, J. M., Corp. 192

I

Indoil Chemical Co. 173
Industrial Ovens, Inc. 271
Institution of the Rubber Industry 260
Interstate Welding Service 174
Irvington Varnish & Insulator Co. —

J

Jenkins, J. W., Co., Inc. 271
Johnson Steel & Wire Co., Inc. 185

K

Kautschuk und Gummi —

L

Littlejohn & Co., Inc. —

M

Marbon Corp. 162
Marine Magnesium Products, Division of Merck & Co., Inc. —
Martin Fabrics Corp. 249
Maryland Cork Co. 274
Merix Chemical Co. —
Monsanto Chemical Co. 169
Mt. Vernon-Woodberry Mills, Inc. 247
Muehlstein, H., & Co., Inc. 239

N

National Lead Co. —
National Rosin Oil Products, Inc. 269
National Rubber Machinery Co. 166
National Sherardizing & Machine Co. 271
National-Standard Co. 158
Naugatuck Chemical, U. S. Rubber Co. 147, 194
Neville Co. 175
New Jersey Zinc Co. 152

O

Olin, R. R., Laboratories 271
Osborn Mfg. Co. 163

P

Pan American Chemicals Div.,
Pan American Refining Corp. 263
Pennsylvania Industrial Chemical Corp. —
Pequanoc Rubber Co. 273
Phillips Chemical Co. 144
Phillips Petroleum Co. 171
Pike, S. J., & Co., Inc. 162
Pittsburgh Coke & Chemical Co. 177
Polymel Corp. 141

R

Rand Rubber Co. 269
Randall, Frank E., Co. 248
Rare Metal Products Co. 269
Rasor, Donald J., Sr. 271
Richardson, Sid, Carbon Co. 276
Rotex Rubber Company, Inc. 272
Royle, John, & Sons 253
Rubber Corp. of America, Latex Div. 259
Rubber Engineering & Chem. Co. 273
Rubber Raw Material —

S

St. Joseph Lead Co. 170
Schrader's, A., Son 167
Schulman, A., Inc. Inside Back Cover
Scott Testers, Inc. 259
Sharples Chemicals Inc. —
Shaw, Francis, & Co., Ltd. —
Shell Chemical Corp. 191
Shell Oil Company, Inc. —
Simplex Cloth Cutting Machine Co., Inc. —
Sindar Corporation —
Sivon Machine Co. 248
Skelly Oil Co., Solvents Div. —
South Florida Test Service 271
Southeastern Clay Co. —
Southern Clays, Inc. 184
Southland Cork Co. 271
Spadone Machine Co. —
Spencer Products Co. 275
Stamford Rubber Supply Co. 265
Standard Machinery Co. 257
Stanley Chemical Co. —
Stanley Electric Tool Div. —
Stauffer Chemical Co. —
Stein, Hall & Co., Inc. —
Stoner's Ink Co. 275
Sun Oil Co. 179
Synvar Corporation —

T

Tanney-Costello Inc. —
Taylor Instrument Companies 164
Testworth Laboratories, Inc. —
Textile Proofers Inc. 256
Thomaston Mills 261
Titanium Pigment Corp. 176
Tracerlab, Inc. 172
Tumpeer Chemical Co. 255
Turner Halsey Co. 247

U

United Carbon Co. Insert Following 158
United Engineering & Foundry Co. 181
United Rubber Machinery Exchange 267
U. S. Rubber Reclaiming Co. 150
Utility Mfg. Co. 249

V

Vanderbilt, R. T., Co. Front Cover
Velsicol Corp. —

W

White, J. J., Products Co., Inc. 255
Whittaker, Clark & Daniels, Inc. —
Williams, C. K., & Co. —
Wills Rubber Trimming Machine Co. 250
Wilson, Charles T., Co., Inc. 265
Witco Chemical Co. Back Cover
Woloch, George, Co. 125
Wood, R. D., Co. 161
Wyandotte Chemicals Corp. 189

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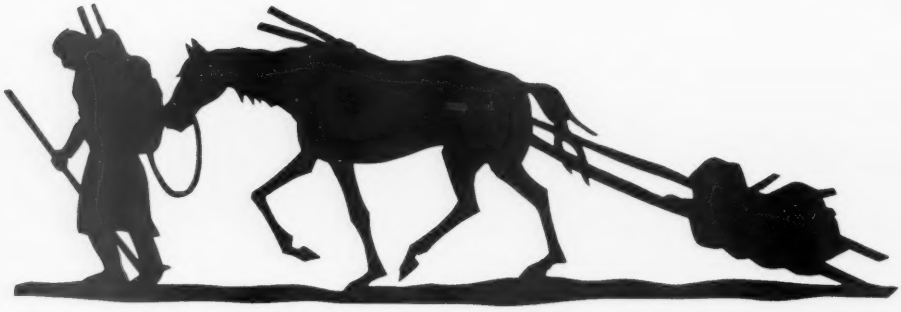

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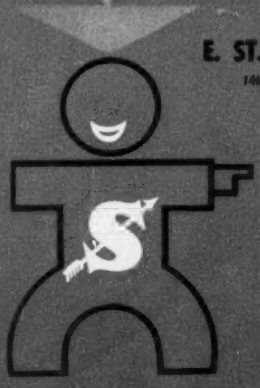

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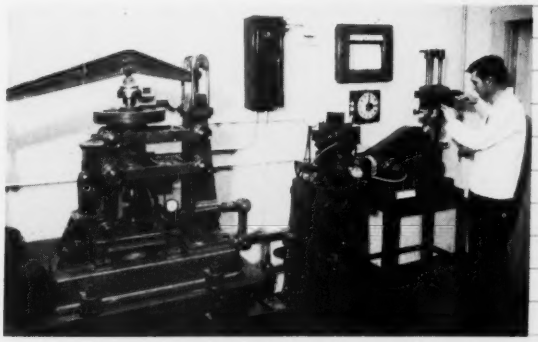

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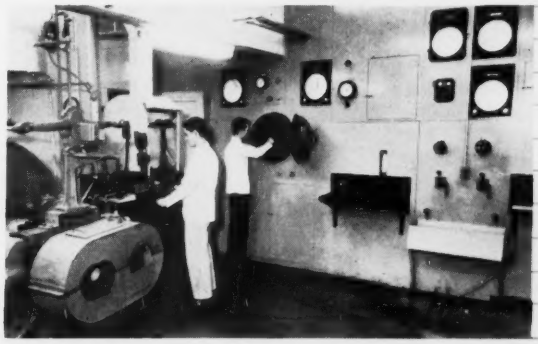

Sectional view of laboratory mill room showing
rubber mills, open steam vulcanizer, curing presses.

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